OIPE JC110 JUN 18 2003 PATENT & TRADEMARK OFFICE
MAIL DATE CANCELLED

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PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

OIPE JC110 JUN 17 2003 PATENT & TRADEMARK OFFICE

In Re the Application of:

Henning Von Spreckelsen and
Peter M. McGeough

Serial No.: 09/701,057

Filed: November 22, 2000

Atty. File No.: 44257.830001

For: "THIN-WALLED PLASTICS BOTTLE, CLOSURE AND BOTTLING PROCESS"

Art Unit: 3727

Examiner: Nathan J. Newhouse

Confirmation No.: 7735

TRANSMITTAL OF APPEAL BRIEF

"EXPRESS MAIL" MAILING LABEL NO.: EL 415724718 US
DATE OF DEPOSIT: June 17, 2003

I HEREBY CERTIFY THAT THIS PAPER OR FEE IS BEING DEPOSITED WITH THE UNITED STATES POSTAL SERVICE "EXPRESS MAIL POST OFFICE TO ADDRESSEE" SERVICE UNDER 37 C.F.R. 1.10 ON THE DATE INDICATED ABOVE AND IS ADDRESSED TO THE COMMISSIONER FOR PATENTS, ALEXANDRIA, VA 22313.

PRINTED NAME: Sherry Soares

SIGNATURE:

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Enclosed please find in triplicate an "APPEAL BRIEF" for the above-identified patent application. Also enclosed please find a check in the amount of $320.00 as fee for filing a brief in support of an appeal for a large entity. Please credit any overpayment or debit any underpayment to Deposit Account No. 08-2623.

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Respectfully submitted,

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Date: 6/17/03

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PATENT & TRADEMARK OFFICE

#14/Appeal Brief
h Nurse
6/26/03

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APPEAL BRIEF

Dear Sir:

This is an appeal to the Board of Patent Appeals and Interferences from the Examiner's final rejection of claims 12-16 of the above-identified patent application. This final rejection was mailed on December 31, 2002.

(1) REAL PARTY IN INTEREST:

The real party in interest is Spreckelsen McGeough Limited.

(2) RELATED APPEALS AND INTERFERENCES:

There are no appeals or interferences which are believed to relate to this appeal.

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(3) STATUS OF CLAIMS:

The claims remaining in this application are finally-rejected claims 12-16.

No claims are allowed.

Claims 1-11 have been cancelled.

(4) STATUS OF AMENDMENTS:

An amendment after final rejection was filed on February 21, 2003.

In an advisory action mailed on April 2, 2003 the Examiner (1) maintained the 35 USC 103(a) final rejection of claims 12-16, and (2) stated that for purposes of appeal the amendment after final rejection would be entered.

The amendment after final rejection (1) canceled non-elected claims 2-6, (2) canceled independent claim 11 and resubmitted claim 11 as a new independent claim 16, and (3) amended independent claim 12.

(5) SUMMARY OF APPELLANTS' INVENTION:

The present invention relates to the art of fluid packaging.

An example of a container for use in fluid packaging in accordance the invention is a one-gallon dairy container, which container is a thin-walled extrusion-blow-molded container in its entirety, the container weighting about 60 grams.

The importance of this invention is evidenced by the fact that some 7 billion one-gallon dairy containers are sold each year in the United States. Using the present invention to provide both a primary-seal and a secondary-seal for such commonplace dairy containers is of great economic value.

The present invention is a deceivingly simple invention that results from an appreciation of the technical problems that are associated with container-weight and cap-resealability, which problems this invention simultaneously solves by the use of an injection molded neck-and-cap assembly that is fitted or fused to an extrusion blow molded bottle in a permanent manner, wherein a tearable primary-sealing foil is located intermediate the neck-and-cap assembly and the bottle, and wherein after the injection-molded cap has been manually removed, and the foil has been manually torn, thus opening the bottle, the bottle can be secondary-resealed by replacing the injection-molded cap on the injection-molded neck.

The present invention allows a bottle, such as a dairy container, to be light-weight because the present invention eliminates the need to form a screw-threaded neck on the extrusion-blow-molded bottle.

This invention also allows such an extrusion-blow-molded bottle to be thin and light-weight due to the reduced force that is applied to the bottle as the neck-portion of the invention's injection-molded neck-and-cap assembly is secured to the extrusion-blow-molded bottle, and as a foil is secured between the extrusion-blow-molded bottle and the neck-portion of the injection-molded neck-and-cap assembly, this foil forming a primary-seal, and this force being lower than a capping-force that must be applied to the extrusion-blow-molded bottle when an injection-molded cap is directly applied thereto.

The present invention also solves a prior-art problem that is created when one attempts to achieve a good seal between a thin-walled extrusion-blow-molded bottle and an injection-molded cap that is intended to seal the neck of the bottle in a resealable manner.

As stated at page 2, lines 8-15 of the specification, this prior-art problem results from the fact that the dimensional tolerance of an extrusion-blow-molded bottle's open-neck is about 0.3

mm, whereas the dimensional tolerance of an injection-molded cap is about 0.1 mm. This difference in dimensional tolerance causes a proportion of the injection-molded caps to not seal tightly, both when initially fitting a cap to the extrusion-blow-molded bottle's open-neck, and later when the cap is used to reseal the bottle's open-neck.

The present invention provides a neck-and-cap assembly wherein an injection-molded neck is fused to an extrusion-blow-molded bottle, and wherein an injection-molded cap is removably secured to the injection-molded neck. In this manner a replaceable injection-molded cap is provided for the extrusion-blow-molded bottle by way of a new and unusual arrangement that is not sensitive to differences in the dimensional tolerances that exist between the injection-molded cap and the extrusion-blow-molded bottle.

With reference to the present application at (1) FIGS. 2, 5 and 6, at (2) the specification at page 7, lines 4-16, and at (3) the specification at page 8, lines 12-15, the present invention provides a new and unusual combination of:

(1) An extrusion-blow-molded and non-gas tight bottle-body 2 having a top-disposed open mouth 4 for receiving a liquid,

(2) An injection-molded neck-assembly 16,

(3) A tearable sealing foil 70, and

(4) A resealable injection-molded cap 50.

In this new and unusual arrangement, a permanent weld or seal is provided at the physical location where extrusion-blow-molded bottle-body 2, sealing foil 70 and injection-molded neck assembly 16 meet, and a resealable seal is provided above foil 70 at the physical location where injection-molded cap 50 and injection-molded neck assembly 16 meet. Before foil 70 is torn,

this permanent seal provides a closure for bottle-body 2 and its liquid content. After foil 70 has been torn, this resealable cap 50 provides a closure for bottle-body 2 and its liquid content.

In this arrangement (and as claimed in independent claim 16) the open bottom-portion of injection-molded neck-assembly 16 is fused to extrusion-blow-molded bottle-body 2, so as to surround the bottle's open-mouth 4, after bottle 2 has been filled with a liquid, and a tearable sealing foil 70 is bonded between neck-assembly 16 and the bottle's open-mouth 4. In this way, the bottle's open-mouth 4 is sealed until such time as foil 70 is torn. For example, see the specification at page 7, lines 4-8, and at page 15, line 19, to page 16, line 12. The open top-portion of neck-assembly 16 is then closed by injection-molded and resealable cap 50.

Later, cap 50 can be removed when it is desired to open bottle 2 by tearing foil 70. This opening of bottle 2 facilitates the pouring of liquid out of open-mouth 4. Thereafter cap 50 can be replaced on the top-portion of neck-assembly 16, to thereby again seal bottle 2.

As described beginning at page 17, line 1, of the present specification (and as claimed in independent claim 12) the present invention provides a process wherein plurality of the above-described bottles 2 are extrusion-blow-molded and then filled with a liquid.

Each of the filled bottles 2 are then fitted with a sterilized and foiled injection-molded neck-and-cap assembly.

As is perhaps best seen in FIG. 5, each neck 16 and cap 50 assembly includes;

(1) A generally cylindrical-shaped and injection-molded neck 16 that provides a generally cylindrical opening that is closed by a foil 70;

(2) Neck 16 provides an open top-portion that is located above foil 70;

(3) A resealable injection-molded cap 50 is removably secured to this open top-portion of neck 16; and

(4) Neck 16 provides an open bottom-portion that is located below foil 70 and is sized to fit the profile 6 of the open mouth 4 of an extrusion-blow-molded bottle-body 2.

In this process neck 16 is assembled to bottle-body 2 with sealing foil 70 being located therebetween, wherein foil 70 is preferably already bonded to the neck-and-cap assembly (for example see the specification at page 15, line 19, to page 16, line 12).

As described at page 17, lines 8-15, of the specification (and as claimed in claim 13) foil 70 is sterilized prior to fitting an injection-molded neck-and-cap assembly onto each of the filled bottles 2.

As described at page 17, lines 1-7, of the specification (and as claimed in claim 14 and 15) the step of extrusion-blow-molding a plurality of bottles 2 is achieved using a rotary machine wherein a series of molds pass under a diehead, wherein a parison is supplied to each mold, and wherein each parison is then inflated to form a bottle 2. The bottles 2 that are thus formed can be passed directly to a fluid-filling station.

In the construction and arrangement according to the present invention, a good primary seal and a good secondary seal are achieved for an extrusion-blow-molded bottle.

More specifically, in accordance with the present invention dimensional tolerances between an injection-molded cap and an extrusion-blow-molded bottle cease to be an issue since (1) the injection-molded cap provides a secondary-seal as it mates with an injection-molded neck, and (2) the injection-molded neck and its foil provides a primary-seal as it mates with the open mouth of the extrusion-blow-molded bottle. Once the cap has been removed, the foil has been torn, and liquid has been poured from the bottle, the injection-molded cap can be replaced on the injection-molded neck, to again seal the extrusion-blow molded bottle.

In accordance with the present invention a good primary-seal and a good secondary-seal are provided for a thin-walled, light weight and extrusion-blow-molded bottle, thus resolving a long-standing problem that has been of concern to both liquid-product suppliers and liquid-product consumers for many years.

(6) ISSUES:

Two issues are presented by this appeal.

Issue-I (Relating to independent claim 16):

Does U.S. Patent 4,815,618 to Gach that provides a container 10 having an open-cylinder neck 14, a closure 18 that includes a disk 62 and is mounted on container neck 14, a foil liner-seal 56 that is coated with a heat sealing compound, and a lid 40, wherein after closure 18 is placed onto a filled container 10, the coating on foil 56 is heated to weld foil 56 to the closure's disk 62 and to the container's neck 14, to thereby seal container 10;

when combined with the teachings of U.S. Patent 6,117,506 to Graboski et al that provides an extrusion blow molded three-layer bottle 10 whose neck portion 13 is shown as having external threads of the type conventionally used with a screw-cap;

render obvious appellants' assembly-claim 16 wherein an injection-moulded neck-assembly is fused to an extrusion-blow-molded bottle-body with a tearable sealing foil being bonded therebetween, and wherein a resealable injection-moulded cap is fitted to the injection-moulded neck-assembly to provide a resealable closure for the bottle-body after the foil is torn?

Issue-II (Relating to independent claim 12 and its dependent claims 13-15):

Does above-mentioned USP 4,815,618 to Gach;

when combined with above-mentioned USP 6,177,506 to Graboski et al;

when combined with USP 6,082,568 to Flanagan that provides a container having a thread-attached injection molded cap 15 and an intermediate-located tamper-evident liner 8;

render obvious appellants' process for bottling a fluid wherein a plurality of thin-walled and non-gas-tight bottles are extrusion blow molded and then filled with a liquid, wherein the filled bottles are then fitted with an injection-molded neck-and-cap assembly having both an intermediate-located foil and a resealable injection-molded cap, and wherein the foil is heat-sealed to the neck-and-cap assembly?

(7) GROUPING OF CLAIMS:

Appellants hereby give notice that finally-rejected claims 12-16 do not stand or fall together.

Appellants respectfully submit that the following two claim groups Group-I and Group-II should be considered separately when the question of patentability is considered. The following two groups of claims are believed to be patentably distinct in that;

Group-I independent claim 16 is directed to a thin walled plastic bottle assembly having (1) an extrusion-blow-moulded and non-gas-tight bottle-body, (2) an injection-moulded neck-assembly whose bottom portion is fused to the bottle-body, (3) a tearable sealing foil that is bonded between the neck-assembly and the bottle-body, and (4) a resealable injection-moulded cap that is fitted to a top of the neck-assembly.

Group-II independent claim 12 is directed to a process for bottling a fluid by (1) extrusion-blow-molding a plurality of thin-wall and non-gas-tight bottle-bodies, (2) filling the bottle-bodies with a liquid, (3) fitting each filled bottle-body with an injection-molded neck-and-cap assembly whose neck is covered by a foil and whose top carries a resealable injection molded cap, and (4) heat-sealing the foil to the bottle-body.

Dependent Group-II claim 13 includes a foil sterilizing step prior to fitting the filled bottle-body with an injection-molded neck-and-cap assembly.

Dependent Group-II claim 14 includes the step of extrusion-blow-molding the bottles-bodies using a rotary machine having a series of molds that pass beneath a die-head that supplies a parison to each mold.

Dependent Group-II claim 14 includes the step of passing the bottle-bodies directly from a mold to a filling station.

Summary of the Examiner's final rejection mailed December 31, 2002:

Paragraph 3 of the Examiner's final rejection rejects independent assembly-claim 12 (now independent assembly-claim 16) as unpatentable (35 U.S.C. 103a) over (1) U.S. Patent 4,682,702 to Gach in view of (2) U.S. Patent 6,117,506 to Graboski et al.

The Examiner notes that Gach's container 10 is not extrusion-blow-molded, is not thin walled, and is not non-gas tight. The Examiner then cites the patent to Graboski et al for its three-layer bottle 10 that may be fabricated using the FIG. 1 and 2 extrusion blow molding apparatus, the Examiner stating "it would have been obvious ----- to make the bottle of Gach by extrusion blow molding to form a 'thin walled' bottle made of high density polyethylene as

taught by Graboski et al to provide a bottle which protects its contents from degradation from light".

Paragraph 4 of the Examiner's final rejection rejects independent process-claim 12 as unpatentable (35 U.S.C. 103a) over (1) U.S. Patent 4,682,702 to Gach in view of (2) U.S. Patent 6,117,506 to Graboski et al (as applied to above-discussed independent claim 12, now independent claim 16), and further in view of (3) U.S. Patent 6,082,568 to Flanagan.

The Examiner recognizes that Gach does not teach the method-step of forming both a cap and a neck assembly by injection molding. The Examiner then cites Flanagan for its teaching of a cap 15 that is preferably injection molded, the Examiner stating "it would have been obvious ---- to make the cap and neck assembly of Gach by injection molding as taught by Flanagan as this is a well known method of making caps".

Paragraph 5 of the Examiner's final rejection rejects dependent process-claim 13 as unpatentable (35 U.S.C. 103a) over (1) U.S. Patent 4,682,702 to Gach in view of (2) U.S. Patent 6,117,506 to Graboski et al and (3) U.S. Patent 6,082,568 to Flanagan (as applied to above-discussed independent claim 12), and further in view of (4) U.S. Patent 6,076,334 to Kitahora et al.

The Examiner recognizes that the Gach as above-modified does not teach the step of sterilizing the foil prior to the fitting step. The Examiner cites Kitahora et al which teaches a sterile chamber 30 whereat a sterile beverage 18 is supplied to fill blow-molded containers, the Examiner stating "it would have been obvious ---- to sterilize the cap and neck assembly of Gach as taught by Kitahora et al prior to applying the cap and neck assembly to the bottle".

Paragraph 6 of the Examiner's final rejection rejects dependent process-claims 14 and 15 as unpatentable (35 U.S.C. 103a) over (1) U.S. Patent 4,682,702 to Gach in view of (2) U.S.

Patent 6,117,506 to Graboski et al and (3) U.S. Patent 6,082,568 to Flanagan (as applied to above-discussed independent claim 12), and further in view of (4) U.S. Patent 4,141,680 to Kauffman et al.

The Examiner recognizes that Gach, as above modified, does not teach forming the bottles by using a rotary machine. The Examiner cites Kauffman et al wherein a continuous-motion blow-molding apparatus forms bottles, the Examiner stating "it would have been obvious ---- to make the bottle of Gach by a rotary extrusion blow molding as taught by Kauffman et al as this is a well known method of extrusion blow molding bottles".

Summary of, and comment relative to, USP 4,815,618 to Gach:

The Gach patent provides (1) a container 10 having an open-cylinder neck 14, and (2) a closure having a disc 62 and a downwardly-extending skirt 22. A surface 28 of skirt 22 is force-fit into a recess 16 that is provided in the container's cylindrical neck 14, and the upper surface of closure 18 includes a nozzle 34 that is closed by a hinged lid 40 that friction-fits to a rim 54.

A disk-like foil 56 extends across the open-top of cylinder neck 14. Foil 56 is heat-sealed (1) to disc 62, (2) to the lower face of section 32, and (3) to the lip of neck 14.

A pull-ring 66 is attached to disc 62 such that pulling on ring 66 breaks disc 62 and tears foil 56.

COMMENT: Note that this patent to Gach is discussed at page 6 of the present specification.

It is significant that Gach does not describe the manner of molding either container 10 or closure 18, and that Gach does not address the issue of the weight of container 10.

Gach requires the force-fitting of skirt 22 onto Gach's container's neck 14. Thus, Gach's container 10 must be of a weight, and of a wall-structure, that will resist this fitting-force. This teaching of Gach is entirely incompatible with the requirement of finally-rejected claims 12-16 that a bottle in accordance with the present invention is a thin-walled bottle.

Importantly, Gach does not provide an injection-molded neck and injection-molded cap assembly, wherein the injection-molded neck is fused to an extrusion-blow-molded bottle, to thereby provide a resealable injection-molded cap for the extrusion-blow-molded bottle by way of a construction and arrangement that is not sensitive to differences in the dimensional tolerances that exist between the injection-molded cap and the extrusion-blow-molded bottle.

Summary of, and comment relative to, USP 6,117,506 to Graboski et al:

The Graboski patent provides an extrusion-blow-molded bottle 10 having a body portion 12 and a neck portion 13 that includes external threads. Three resins are used to provide a bottle 10 having three-layers, i.e. an outer layer 14, an inner layer 16 that contains a colorant, and an intermediate layer 18 that contains a colorant.

In making a bottle 10 a die block 24 provides a parison 31 to a mold 38, and air is injected through a bore 34.

COMMENT: Graboski does not address the issue of the weight of bottle 10, instead Graboski discloses a three-layer extrusion-blow-molded bottle10.

Graboski's does not contemplate the use of a sealing foil.

Graboski does not provide an injection-molded neck and injection-molded cap assembly, wherein the injection-molded neck is fused to an extrusion-blow-molded bottle, to thereby provide a resealable injection-molded cap for the extrusion-blow-molded bottle by way of a construction and arrangement that is not sensitive to differences in the dimensional tolerances that exist between the injection-molded cap and the extrusion-blow-molded bottle.

Summary of, and comment relative to, USP 6,082,568 to Flanagan:

The Flanagan patent provides a glass, plastic, or laminate container 1 having a neck 2 that carries external threads. An injection molded cap 15 and its internal threads closes the top of container 1, and a tamper-evident liner 8 lies intermediate the rim 17 of container 1 and the underside of cap 15. A hinged cover 4 may be lowered to cover a dispensing orifice 5 that is carried by cap 15.

COMMENT: While Flanagan discloses an injection-molded cap 15, Flanagan does not provide a solution to the problem of mating an injection-molded neck-and-cap assembly to an extrusion-blow-molded bottle, and Flanagan does not address the issue of the weight of the container.

Summary of, and comment relative to, USP 6,076,334 to Kitahora et al:

The Kitahora patent provides a beverage packaging system having a sterile chamber 30 wherein a plastic container that is received from a blow molding machine 14 is filled at a filler unit 16. Beverage 18 is sterilized at 20, and the sterilized beverage is then supplied to a filler

unit 16 that is within chamber 30. Metal caps from supply 24 are fed to a cap clamper 22 whereat a filled container is capped.

COMMENT: While Kitahora discloses a sterile beverage packing system, Kitahora does not provide a solution to the problem of mating an injection-molded neck-and-cap assembly to an extrusion-blow-molded bottle, Kitahora does not address the issue of the weight of the bottle, and Kitahora does not contemplate the use of plastic caps and sealing foils.

Summary of, and comment relative to USP 4,141,680 to Kauffman et al:

The Kauffman patent provides a continuously-operating blow-molding machine wherein a multi-station parison loading turret 10 and its constant-speed transfer means 12 conveys tubular parisons into operative positions within the individual molding stations 13 of a multi-station blow molding turret 14. The parisons are blown into a bottle whose neck includes external threads (see FIG. 58), the bottles are cooled, and the cooled bottles are ejected at ejection means 17.

COMMENT: While Kauffman provides a continuously operating blow-molding machine for making bottles whose necks have external threads, Kauffman does not provide a solution to the problem of mating an injection-molded neck-and-cap assembly to an extrusion-blow-molded bottle, and Kauffman does not address the issue of the weight of the bottles.

(8) ARGUMENT:

The present invention solves a long standing problem of reliably mating a resealable injection-molded cap to an extrusion-blow-molded and thin-walled bottle wherein a mismatch exists between the dimensional tolerance of the injection-molded cap and the dimensional tolerance the extrusion-blow-molded thin-walled bottle.

Prior to the present invention such a bottle had to resist the force-load of applying such a cap directly to the bottle. This resulted in the bottle's weight being such that the bottle provided a structural-strength that resisted a top loading force of about 22 pounds as the cap was directly applied thereto.

The present invention and its injection-molded neck-and-cap assembly provides that the resealable and injection-molded cap is applied to the neck of an injection-molded neck-and-cap assembly before the neck-and-cap assembly is fitted or fused to the extrusion-blow-molded bottle. Thus the extrusion-blow-molded bottle-body can be a light-weight and thin-walled, having even thinner walls since the top loading force that is applied to the bottle is only a relatively low force (typically about 7 pounds) that is required in order to effect welding the neck-and-cap assembly and its foil to the light-weight and thin-walled bottle.

In addition, the simple open-mouth structure that is provided at the mouth of a bottle-body in accordance with the present invention does not require a threaded neck as is, for example, provided in the standard 7 billion US diary containers per year, and such as is provided in Graboski, Flanagan and Kauffman. More specifically, the simple open-mouth structure of the present invention provides about a 2 gram reduction in weight of the bottle's neck alone.

When the advantages of the present invention are considered in a price-sensitive market such as dairy and juice packaging, including savings in the construction and arrangement of the

bottle-body, it is not surprising that the present invention has been recognized as a significant technical advance.

Given the substantial economic value of the present invention, and given that in a hindsight manner the Gach construction might be rebuilt in the manner suggested only by the present inventors, it is respectfully submitted that it is not obvious to rebuild Gach as the Examiner suggests. That is, if rebuilding Gach as suggested by the Examiner is obvious, why did the problem of applying an injection-molded cap to an extrusion-blow-molded bottle remain unsolved for a relatively long time?

As evidence of the value of the present invention, appellants attached Exhibits A-F, wherein

Exhibit A includes an article entitled "UK firm launches bottle technology" describing the present invention as a "revolutionary extrusion blow molding closure technology";

Exhibit B provides an article entitled "TECHNOLOGY WORTH WATCHING" that describes the present invention and the advantages that it brings to the art;

Exhibit C provides an article entitled "UNIQUE CLOSURE AIMS TO REDUCE LEAKS IN BLOWMOLDED BOTTLES" that describes the present invention and the advantages that is brings to the art;

Exhibit D provides an article entitled "Will PET go this way?" in which the present invention is described as "a revolutionary new closure concept";

Exhibit E provides an article entitled "Revolution in closure technology" wherein it states "A development by the UK based company Spreckelsen McGeough looks set to ask some serious questions of the plastics container business. A new patented closure

system, the BAP (closure), is a simple yet revolutionary method of welding an injection moulded neck onto a blow moulded bottle after it has been filled"; and

Exhibit F provides an article entitled "BAP: newly developed closure technology" that describes the present invention and the advantages that is brings to the art.

It is respectfully submitted that the Exhibit A-F recognition of the revolutionary nature of the present invention is clear evidence of the nonobviousness of finally rejected claims 12-16.

In addition appellants provide a copy of granted UK Patent GB 2 353 789 B (Exhibit G) and a copy of granted Australian Patent 752089 (Exhibit H) showing that the present invention has been recognized as non-obvious by the UK Patent Office and the Australian Patent Office.

It is respectfully submitted that the recognition of the present invention as is shown in Exhibits A-H speak highly of the non-obviousness of finally-rejected claims 12-16.

Extrusion blow molded bottles have been widely available for some time, and Graboski's three-walled bottle 10 is an example. Also, injection molded caps have been available, Flanagan's cap 15 being an example.

The fact that bottles and caps of this type have been available, and yet no one other than the present inventors has solved the long standing problem of reliably mating an injection-molded cap to an extrusion-blow-molded bottle speaks highly for the patentability of the present invention.

The Examiner's final rejection of claims 12-16 is one of obviousness under the provisions of 35 USC 103(a). That is, the Examiner asserts that the differences between the subject matter defined by claims 12-16 and the prior art are such that the subject matter as a whole would have been obvious to a person having ordinary skill in the art to which the subject matter pertains.

In finally rejecting claims 12-16 of the present application the Examiner has combined the teachings of a number of US patents.

It is well established that the Examiner's combination of these patents must be supported by a suggestion in the cited patents that they be combined as is suggested by the Examiner.

As stated in IN RE MILLS, 16 USPQ2d, 1430 (Fed. Cir. 1990), the mere fact that the patents can be combined does not render the resulting combination obvious unless the patents themselves suggest the desirability of making the combination.

It is deceivingly easy for the Examiner to (1) read the specification and claims of the present application, and (2) with this hindsight-knowledge of the present invention review prior patents and pick and chose patents that contain one or more of the claimed features, and then (3) use these chosen features to modify one of the prior patents in a manner to establish that the claimed invention is obvious. However, this is often improper hindsight-use.

IN RE ROUFFET FED. CIR., NO 97-1492, 7/15/98 addresses the use of hindsight, and states, to prevent the use of hindsight to defeat the patentability of a given invention, this court requires the Examiner to show motivation to combine the references that create the Examiner's case of obviousness, in other words, the Examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor, and with no knowledge of the claimed invention, would select the prior-art elements in the manner cited by the Examiner.

The improper use of hindsight was also addressed in IN RE Dembiczak, Fed. Cir., No. 98-1498, 4/28/99, wherein it was stated that the best defense against a hindsight-based rejection by the Examiner is the rigorous application of the requirement to show a suggestion, a teaching, or motivation to combine prior art references as was done by the Examiner.

The present invention simultaneously solves two problems that have existed for some time when one attempts to minimize container-weight and to also provide a good seal between an injection-molded and reusable cap and a thin-walled extrusion-blow-molded bottle.

For the Examiner's rejection to be a proper rejection there must be some basis for concluding that a person skilled in the art (who has no knowledge of appellants' invention) would be informed that the above-described problems could be solved simultaneously by combining the Examiner's cited patents as is suggested in the Examiner's final rejection.

It is respectfully submitted that the Examiner's cited patents do not themselves suggest the rebuilding of the Gach patent as is suggested by the Examiner, and it is respectfully submitted that the only way the Examiner is able to rebuild the Gach patent is by improperly using a hindsight-knowledge of the present invention.

For example, if one were to modify the Gach patent using the teaching of the Graboski et al patent the only reasonable modification would be to provide that Gach's container be an extrusion-blow-molded container, and preferably a three-layer container as is taught by Graboski, wherein the three-wall container would be of a weight and a wall-thickness that would resist the force-fitting of Gach's closure 18 onto the neck 14 of container 10.

However the Examiner's modified-Gach is still not the whole of the present claimed invention which requires an injection-molded neck to be fused to an extrusion-blow-molded and thin-walled bottle, such that an injection-molded cap that is fitted to the injection-molded neck provides a resealable cap for the bottle independent of dimensional tolerances that exist between the injection-molded cap and the extrusion-blow-molded bottle.

It is respectfully submitted that no combination of the Examiner's cited patents provides the whole of the invention claimed in finally-rejected claims 12-16 of this application.

It is respectfully submitted that only the present application teaches an assembly or a process whereby a thin-walled and extrusion-blow-molded bottle can be reliably provided with an injection-molded and resealable cap, independent of the dimensional tolerances that exist between the extrusion-blow-molded bottle and the injection-molded cap.

Since the invention recited in appellants' Group I and Group II claims, when considered as a whole, is not anticipated or rendered obvious by the Examiner's citations, it is respectfully requested that the Board reverse the Examiner's final rejection of appellant's claims 12-16.

Respectfully submitted,

HOLLAND & HART LLP

By: _____

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Date: 6/17/03

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APPENDIX

Claims 12-16 involved in this Appeal read as follows:

Claim 12. A process for bottling a fluid comprising the steps of:

extrusion-blow-moulding a plurality of thin-walled and non-gas-tight bottle-bodies, each bottle-body having a top-located open-mouth;

filling each of said bottle-bodies with a fluid through said open-mouth of each of said bottle-bodies;

fitting to each fluid-filled bottle-body an injection-moulded neck-and-cap-assembly having an intermediate-located neck that is covered by a foil, having an open top portion to which a resealable injection-moulded cap is removably secured, and having an open bottom portion that is sized to correspond to said open-mouth of each fluid-filled bottle-body; and

heat sealing each bottle-body to said foil of each neck-and-cap-assembly.

Claim 13. A process as claimed in claim 12 including the step of sterilizing said foil prior to said fitting step.

Claim 14. A process as claimed in claim 12 wherein said bottle-bodies are extrusion-blow-moulded using a rotary machine having a series of moulds adapted to pass beneath a single die-head for the supply of a predetermined amount of plastic material to form a parison for each of said moulds, which parison is subsequently inflated to form a bottle-body.

Claim 15. A process as claimed in claim 14 wherein each bottle-body leaving a mould is passed directly to a fluid-filling station.

Claim 16. A thin walled plastic bottle assembly, comprising:

an extrusion-blow-moulded and non-gas-tight bottle-body having a top-disposed open mouth for receiving a liquid;

an injection-moulded neck-assembly having an open top portion and having an open bottom portion fused to said bottle-body so as to surround said open mouth after said bottle-body has been filled with a fluid;

a tearable sealing foil bonded between said neck-assembly and said open mouth so as to seal said open mouth until such time as said foil is torn; and

a resealable injection moulded cap fitted to said top portion of said neck-assembly to provide a leak-free and resealable closure for said bottle-body after said foil has been torn.

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PRW

PLASTICS & RUBBER WEEKLY 18 May 2001 An EMAP Communications Publication

Next step on from telecoms, page 9
MD of Mikron UK Paul Wallis describes how the company plans to fill the void

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Industry celebrates PIA victories

Twelve companies were named the inaugural winners of the Plastics Industry Awards at a gala dinner in London on Wednesday night.

The Hi-Technology Group won the overall Processor of the Year, the judges having praised its ability to "prosper in difficult economic times". Sales and marketing director Richard Brown collected the award from Martin Sixsmith, marketing director of sponsoring company Bayer.

The Personal Contribution to the Plastics Industry award was presented to David Williams of the LINPAC group.

The centre eight pages of this week's issue give details on all the finalists and winners, outlining their entry and comments of judges.

■ See next week's issue for all the news and photographs from the PIA night.

THE WINNERS

the plastics industry awards

Processor of the year Hi-Technology Group
Best technology achievement Sulzer Vascutek
Best sales and marketing initiative Initiative UPU Industries
Best training and development programme Algram Group
Best environmental initiative bpi.recycled products
Personal achiever of the year Andrew Barnetson, BPF EPS
Modern apprentice of the year Ryan Dillon, Schafenacher Vision Systems UK
Product design of the year Kinneir Dufort Design
Materials supplier - polymer producers DuPont Engineering Polymers
Materials supplier - polymer distributors/compounders Albis (UK)
Machinery supplier of the year Netstal
Toolmaker of the year Avenue Mould
Personal contribution to the plastics industry David Williams, LINPAC Group

Lower costs due to simpler design • Customer project commercialisation within three months • 3-year development

UK firm launches bottle technology

Gerry [illegible] 020 8277 [illegible]

A revolutionary extrusion blow moulding closure technology which promises to eliminate leakage, cut manufacturing costs and ease production in liquid packaging applications will be available within three months.

UK plastics packaging firm Spreckelsen McGeough has spent nearly three years developing BAP technology, which will make its debut at Schotland's K-Plast 2001 conference in Germany in October.

It uses an induction heat-seal foil to weld an injection moulded ring-pull closure cap to a pre-filled extrusion blow moulded bottle.

"The developers say this welding process overcomes the dimensional tolerance mismatch between the blow moulded container neck and the injection moulded closure - a mismatch which gives rise to leakage problems in traditional extrusion blow moulding process.

By simplifying the bottle neck design and reducing the material content, the cost of a BAP packaging system will be lower than traditional alternatives, the developers claim.

BAP technology has an obvious application in the dairy sector, but its scope extends into many PP, HDPE and PET packaging applications, according to Henning von Spreckelsen, one of the developers.

"We are targeting applications well outside of milk because of the aseptic filling opportunities," he said.

The developers plan to license the technology to packaging producers around the world and are already involved in a number of major customer projects, the first of which is likely to be commercialised within the next three months.

Spreckelsen said: "We are working on products covering retort sterilisation processes in PET, in the pasteurised food, and in non-food sectors."

Spreckelsen, whose career includes posts at ICI and TetraPak, together with development partner Peter McGeough, formerly at TetraPak, set up the company to develop the BAP system.

Slough-based Capseals Unipac and Husky Injection Molding Systems have also been involved in the development project.

Spreckelsen McGeough 01483 754968
Schotland 00 1 609 466 9191

Merit renews moulding shop

Custom moulder Merit Plastic Mouldings has completed a £175,000 investment programme at its factory at Diss in which the moulding shop has been reconfigured and three more Sandretto moulding machines installed.

Post moulding operations have been moved into a new building.

Managing director Tim Palmer said: "We saw substantial growth last year, which took our turnover beyond £2m for the first time." The reconfigured mould shop will provide room for extra growth, although Palmer sees an opportunity for consolidation this year.

The new moulding machines include 65, 100 and 125-tonne models and bring the company's machine list up to 20. Merit is using the 125-tonne model to produce a laboratory test component for a biosciences company.

Merit 01379 644321

Fire destroyed warehousing and most of the manufacturing facilities at TDI Batteries' plant at Dundee last Friday, bringing production at the company to a standstill. The company, which assembles rechargeable battery packs for mobile phones and portable computer equipment, hopes to resume limited manufacturing in temporary premises made available by Dundee City Council early next week. None of the company's 190 staff were injured in the fire. "It is too early to say how long it will be before full production resumes," a spokesman said. "But the plant will get back up and running." TDI 01382 500050 Photo: The Courier, Dundee

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[illegible] PU chemist, p14; Technical manager, Scotland, p15; Materials specialist, Coventry, p16 Classified pages 14-19

B

FT.com FINANCIAL TIMES

As interested in football results as company results?

TECHNOLOGY WORTH WATCHING: Leakproof milk bottle design TECHNOLOGY WORTH WATCHING

By FIONA HARVEY
Financial Times; Oct 11, 2001

Milk drinkers suffering from pools of the liquid on the bottom of the fridge will be interested by a new bottle-making technique developed by a British packaging company.

Current bottle designs easily allow milk to leak when the bottle is stored on its side. These designs also cause problems for packaging manufacturers, which have to reimburse retailers when many of their bottles turn out to leak.

Spreckelsen McGeough claims its new design is leakproof. Traditional techniques use blow-moulding for the plastic of the bottle and injection moulding for the plastic of the cap and then attach the cap to the bottle. The new system uses injection moulding to create both the cap and the neck. These are then welded on to the blow-moulded bottle, which has already been filled with milk. Drinkers open the bottle using a ring-pull.

The company says the technique will prove cheaper than alternatives because the simplified bottle necks will be easier to manufacture and the bottles will weigh less than previous models. The designs will be shown at a plastics and processing conference later this month. Spreckelsen McGeough, Woking; tel: 01483 770447

C

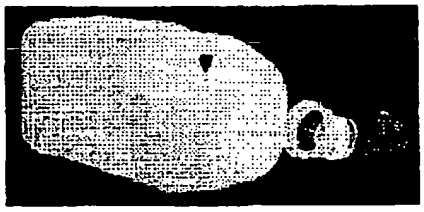
PACKAGING STRATEGIES

Reproduced from Volume 20, No. 4, February 28, 2002

UNIQUE CLOSURE AIMS TO REDUCE LEAKS IN BLOWMOLDED BOTTLES

After three years and more than $2mn in development effort, **Spreckelsen McGeough Ltd.**, a U.K.-based closure development and manufacturing company, has developed a patented three-in-one closure system called *BAP* (Bonded Aluminum Plastic), which is based on the principle of welding a snap-on injection molded spout onto an extrusion blow molded bottle after it has been filled.

Spreckelsen's technical director Peter McGeough says the BAP closure was designed to address the "mismatch" between bottle extrusion blowmolding and cap injection molding tolerances, which leads to leaks in many closures on lightweight blowmolded bottles.



The BAP closure consists of a snap-on portion which is applied to the neck of the container (which includes the plastic ring-pull feature), a pre-inserted barrier foil liner, and an overcap which offers reclosability.

According to Spreckelsen McGeough managing director Henning von Spreckelsen, the initial application for the company's BAP closure will be on pasteurized followed by aseptic or ESL (extended shelf life) HDPE containers for dairy products in Europe and Australia. In addition to HDPE, the BAP closure can be applied to PE, PP, and PET bottles, and the company is currently making efforts to confirm the viability of the closure concept for retort and hot-fill applications.

The BAP closure consists of three parts: a snap-on portion which is applied to the neck of the container (which includes a plastic ring-pull feature that permits the easy removal of the foil); a pre-inserted barrier foil liner, which also provides tamper-evidence; and an overcap, which offers reclosability.

To assemble the closure, the top of the foil is induction sealed to the underside of the lip of the snap-on portion; the overcap is then snapped together with this. The underside circumference of the foil is then induction sealed to the top sealing surface of the bottle immediately following the filling operation.

The result is a foil disc, induction sealed around its circumference on both sides, captured between the top sealing surface of the bottle and the bottom surface of the snap-on fitment. The outer surface of the aluminum disc incorporates the ring-pull feature which provides easy opening and tamper evidence. The entire structure is covered with a reclosable cap. The snap-on fitment itself can be designed with either an easy pour or a mouth-friendly circumference.

In addition to the prevention of leaks, von Spreckelsen claims use of the BAP closure results in cost savings because the neck finish of the bottle can be extensively light weighted, since there is no need for threads.

The fact that the bottle neck is fitted to the container after filling also provides a much larger filling aperture to be designed into the bottle, regardless of the cap size, which in turn increases filling speeds and allows bottlers to increase output from existing equipment.

According to von Spreckelsen, for an aseptic packaging operation, the BAP closure would either need to be assembled and the underside of the foil then sterilized in the sterile filling chamber or, alternatively, pre-assembled closures can be radiation sterilized in a sterile environment immediately prior to induction sealing to the top sealing surface of the container.

The BAP closure is currently in test markets in Europe and will soon be launched commercially in Australia through Spreckelsen McGeough's manufacturing joint venture BAP Tech Pty Ltd. during the first half of this year.

Contact: At **Spreckelsen McGeough Ltd.**, Henning von Spreckelsen, Tel: +44 1483 756 955; Fax: +44 1483 770 447; E-mail: hvonspreckelsen@dial.pipex.com. [PS]

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PET insider ISSUE 10 / 2001

Closures

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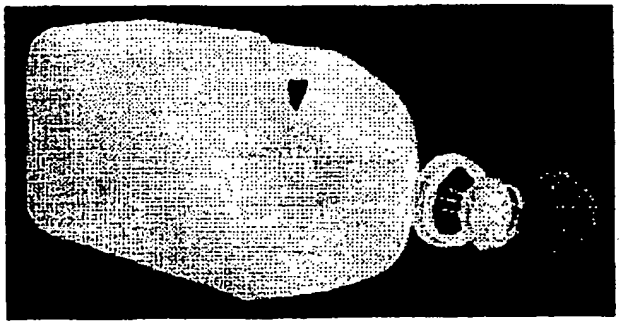
Birkner's Internet-Database of the International Beverage Industry

Will PET go this way?

A revolutionary new closure concept, originally designed for HDPE milk bottles, is sure to have its impact on PET bottling.



Leaking between the cap and the bottle is a common problem with extrusion blow moulded bottles where neck finish tolerances can vary by as much as +/- 0.3 mm. Various types of cap have been developed, especially for use by the dairy industry where leaking bottles can be a major problem for fillers, retailers and consumers. However none of the developments so far seem to solve the problem, which is inherent in the lightweight extrusion blow moulded neck finish.

Now a UK company, Spreckelsen McGeough, have taken a fresh approach to an old problem. "If the problem lies in the extrusion blow moulded neck finish then why not use an injection-moulded neck?"

The result is the "BAP" closure – a cap, foil seal and bottle neck all in one, which is welded to the HDPE bottle after filling.

How it works

The BAP closure consists of a cap and a precision injection moulded bottle neck with a pourer lip. The lower end of the neck is sealed with an induction welded aluminium foil which itself includes an integrated pull ring. The snap-on cap is supplied already fitted to the bottle neck. Immediately after filling the BAP closure is placed on top of the bottle and the lower surface of the foil is welded to the open bottle neck. This results in a highly effective seal between the bottle and the BAP closure, which are in effect welded to either face of the aluminium foil. When the cap is removed the consumer opens the container by simply tearing out the central area of the aluminium foil using the integrated pull-ring, and discards it. The remaining narrow annular section of foil continues to perform its role in welding together the two parts of the bottle. The bottle can be successfully resealed using the snap-on cap only. By using an injection-moulded neck finish and an injection-moulded cap a high quality secondary seal is easily achievable.

Tests carried out by Spreckelsen McGeough indicate that the seal achieved is far superior to that achieved using a conventional valve cap or foil cap.

Additional advantages

The role of the BAP closure in reducing leakage in extrusion blow moulded bottles is clear, but there are other, less obvious advantages. For the bottler there is a considerable saving on material, with the ability to use even lower bottle weights. The fact that the bottle neck is fitted after filling totally divorces the neck finish from the filling aperture – in other words a much larger diameter filling aperture can be designed into the bottle, regardless of the selected cap size, increasing filling speeds and enabling bottlers to increase output from existing equipment. The designers claim that these features alone more than compensate for the additional cost of the BAP closure.

A disadvantage of many foil seals is the difficulty in removing them, either because they are too firmly welded to the bottle or because the pull-tab is too small to grip. The BAP pull-ring foil provides tamper evidence as well eliminating this problem. And the precision moulded lip makes it easy to pour, even from a lightweight 3 or 5 litre bottle of milk.

Add all of this to the savings in clean-up costs, consumer returns and loss of goodwill related to leakers, and the BAP closure looks a good bet.

Additional applications

Because PET neck finishes are injection moulded they do not present the leakage problem seen in HDPE, but BAP technology also has potential applications in aseptic filling, retort sterilisation filling and other areas. Spreckelsen McGeough, with the help of Husky Injection Moulding Systems, are now looking at applications in the PET field where material cost savings and other technical advantages could be significant. Watch this space!

Samples are also available in screw-on versions, including wide mouth.

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other multilayer PET preform systems. The two production systems have been sold to a single customer in Asia and will be installed and supported by Kortec Asia Ltd. based in Hong Kong. Paul Swenson, President of Kortec, said "This commitment by our customer shows the overwhelming acceptance of multilayer as a complete solution for high barrier PET containers".

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154 **Revolution in closure technology**

A development by the UK based company Speckelsen McGeough looks set to ask some serious questions of the plastic container business. A new patented closure system, the BAP, is a simple yet revolutionary method of welding an injection moulded neck onto a blow moulded bottle after it has been filled. The container is opened by a ring-pull system. Cost reduction claims are based on simplified neck design, lower bottle weights and fewer incidents of product leakage. Although the new concept was kept under wraps while development work was going on with customers worldwide, its success in pasteurised, aseptic and sterilised liquid foods (in PP, PE and PET) has led Speckelsen McGeough to present BAP to a wider public during the K-Plast 2001 exhibition in Düsseldorf in October. The presentation will be part of the Global Conference on New Plastics Materials and Processing Technologies organised by Schotland Business Research at the Swissôtel in Neuss. Further information on the conference is available from Schotland Business Research, 16 Duncan Lane, Skillman, NJ, USA (++1 609 466 9191, e-mail: info@schotland.com).

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157 **THE FIRST PET EXHIBITION NOW ALSO ONLINE**

PET as a packaging material is on an unstoppable march forward. PET now has a 30% share of the mineral water and CSD (carbonated soft drinks) market, and the trend is steadily upwards. There are also clear upward trends in the beer and milk sectors. Containers for cosmetics and other non-food products are two more markets that PET has found for itself.

After the launch, at the end of 1999, of "PETplanet Insider", the first trade magazine devoted exclusively to the expanding PET market from the granulate to the filled bottle, there is now to be a specialised trade exhibition: PETpoint. PETpoint will be held in parallel with METPACK in Essen, Germany from April 23rd to 27th, 2002.

The first exhibitors have already booked their space, and it's now time for PETpoint to be seen on the Internet. At www.pet-point.net you can find everything that you need to know about the exhibition: the entry forms, the terms and conditions of participation, the prices, or information on the exhibitors. To give new or smaller companies the chance to exhibit there will be three group stands. A part of the exhibition area has been reserved for exhibitors that want only a small amount of space combined with a clearly defined range of exhibition services, in order that they can be present at the show with an economically priced stand. The three group stands will have the following themes: "Recycling", "Dairy products", and "The Art of PET: preforms, bottle design, closures and labelling". PETpoint is expected to present a very wide range of innovative ideas that will be central to the future of the PET market.

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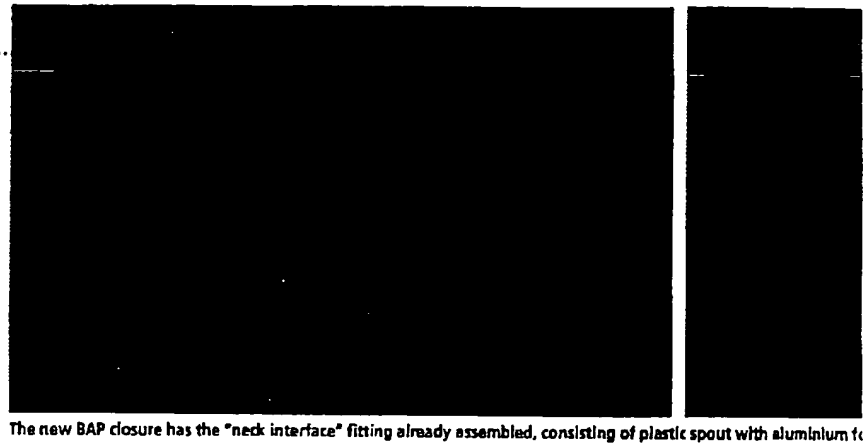
EDM

next year both companies will be introducing both a new aseptic filler for high acid products and a PET barrier coated bottle. In addition, a further investment has been made for the production of injection moulded screw caps and additional PET preform capacity. Thereafter, a linear filler for UHT milk will follow which, according to Potter, will be revolutionary to the European UHT milk market. As announced at the Munich drink technology exhibition by Georg Zuzog, (alfill management), the shelf-life for (ESL) fresh milk will be extended to 14 days, i. e. through highly heated milk with two rinsers in the line (disinfection and sterile water/air), hence enabling the ultra-clean version linear filler to reach a standard of four-log reduction rate.

Co-operation with Techne

Jörg Thiels, Executive Vice President of EPS, announced in Munich that a recent co-operation agreement has been finalized with the Italian producer of extrusion blow moulding machines, Techne in Bologna. Here the customer network of Elopak in the milk and fruit juice industry will be combined together with the technical know-how of Techne. In this way EPS will be able to deliver sterile (e. g. form, fill & seal) mono and multi layer bottles from HDPE and PP for the filling of still products, and thereby extending supply of plastic bottle production and filling lines. The focus here is specifically aimed in the aseptic direction. Techne machines, according to Thiels, are extremely flexible and can be changed over instantly, which is an advantage to the market strategy for the filling companies.

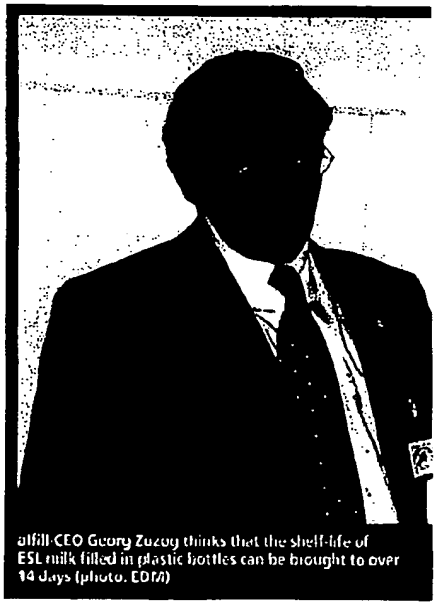


The new BAP closure has the "neck interface" fitting already assembled, consisting of plastic spout with aluminium f

BAP: newly developed closure technology

A further joint project was announced exclusively to "EDM" by Jörg Thiels: the British developer of packaging and closure technology Spreckelsen McGeough Ltd joins its patented system BAP (Bonded Aluminium Plastic) together with the Elopak portfolio. This is a newly created closure system, used for plastic bottles in the high volume price sensitive area of the market. Here it reduces primary leakage (at dairies, retailers and consumers) and secondary leakage (consumers). BAP technology results in a change in the bottleneck, and replaces the normal thread/bottle neck, by a simpler method. This simpler bottle neck seals to a preformed closure element using clip fitting and induction sealing.

The actual closure has the "neck interface" fitting already assembled, consisting of plastic spout with aluminium foil together with a built-in pull-open-ring. In the household the over-cap is lifted, thereby releasing the large dimensional pull-ring. According to the Managing Director, Henning von Spreckelsen, the bottle can then be re-closed and is leak proof. The primary seal of the closure is airtight and can therefore also be used for aseptic products. The BAP technology is relevant to all materials such as PE, PP and PET. According to van Spreckelsen, there are further advantages: the simpler bottleneck offers an approximately 40 per cent larger opening, thus enabling the line filler to run at a much higher production rate. Simultaneously, there is a great saving on the critical bottleneck material, five per



alfill-CEO Georg Zuzog thinks that the shelf-life of ESL milk filled in plastic bottles can be brought to over 14 days (photo. EDM)

The Czech OLMA dairy recently installed a second alfill filling machine to boost its filling capacity to 70 mln litres

Zusammenfassung

gether with a built-in pull-open-ring

Kim Potter of Elopak Plastic Systems aims at establishing plastic bottles for UHT milk in the course of the next year (photo: EDM)

cent with HDPE, and up to 20 per cent with PET. In order to apply BAP closures, only slight modifications are needed to the filling lines, and slight changes to the neck inserts of the bottle blow moulds. BAP technology is currently being introduced in Northern Ireland for the closure of HDPE bottles for cream by Express Dairies. During the next year the largest three drink milk fillers in a not-yet named market outside Europe will also be changing over to BAP closure technology. EDM

Résumé

Elopak Plastic Systems continue à développer sa gamme pour le conditionnement des produits non [illegible]

Proposed Changes to Sidel SA's Status

To make a clear distinction between day-to-day management operations and general supervisory functions, Sidel's Board of Directors has decided to proceed with a conversion of the Group's managing bodies. The Group will soon be adopting a new corporate structure composed of two bodies: the Conseil de Surveillance and Directoire. Jean-Marie Descarpentries is expected to become the first Chairman of the Conseil de Surveillance. The Board also decided that Gérard Stricher will be joining Sidel as the Group's CEO. He will then be named as Chairman of the Directoire as soon as this body is put into place. Stricher, 53, brings international packaging industry experience to the Group. Prior to joining Sidel, he worked for the Carnaud MetalBox Group for eight years and spent six years with the Tetra Pak Group. Efforts to strengthen Sidel's top position began in early September with the arrival of Martin Pinot as the Director of its "Core Business" Operations (including blowing, filling, engineering, and turnkey operations). Pinot has worked for the Rhône-Poulenc Group where his responsibilities included the oversight of the company's polyester business. ❑

Speeding up development

With a new pilot plant in Niebüll, Germany, Danisco intends to accelerate the development of starter cultures. Three years ago, Danisco acquired Wisby, producer of starter cultures and culture media. Today, Danisco claims itself to rank in the world's top four in dairy cultures with expertise in fermentation, i.e. growing cultures in fluid nutrient media. "Earlier this year we commissioned a new state-of-the-art pilot plant, designed to strengthen our fermentation technology," explains Innovation Director Jytte Mollerup Andersen. "We're achieving considerable optimisation of the process while at the same time we're extending our knowledge on cultures and achieving greater flexibility in the development process. The development process will be faster and we'll be able to develop even better products." Not only will the development process be speeded up, but the plant's numerous measuring and control devices also provide Danisco's development people with deeper insight into the keeping quality of dairy cultures. "Thanks to the new plant in Niebüll we've succeeded in producing cultures that can ferment the milk faster, which is also a key parameter to our customers as they can reduce the yoghurt and cheese production time", explains Jytte Mollerup Andersen. ❑

Degussa Texturant Systems: acquisition in Poland

On 23rd October 2001 Degussa Texturant Systems closed the acquisition of Voyer Spolka z.o.o., a company based in Kalisz (near Poznan), Poland. This acquisition provides an important stronghold for Degussa Texturant Systems and will facilitate the expansion of its business in the briskly growing markets of Eastern Europe. Voyer was a privately owned company created at the end of 1993. Within seven years, it raised its turnover up to 18 million DM. Voyer's activities combine the development, production, packaging, distribution and sales of blends, mainly for the meat and dairy industries, but also for fruit and confectionery. Today, the company is established as one of the most important food processors in Poland. Backed by the strong financial, research and development as well as support of Degussa Texturant Systems, the new Degussa affiliate is expected to achieve a turnover of around 22 mln DM in 2002. ❑

Spare Parts for High Pressure Homogenizer

Cost-Cutting

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updated as appropriate

Additional Fields
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Other: **ONLINE - EPODOC, WPI, PAJ**

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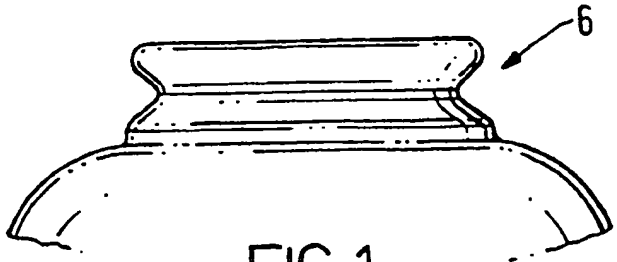

FIG.1

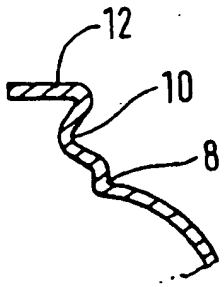

FIG.4

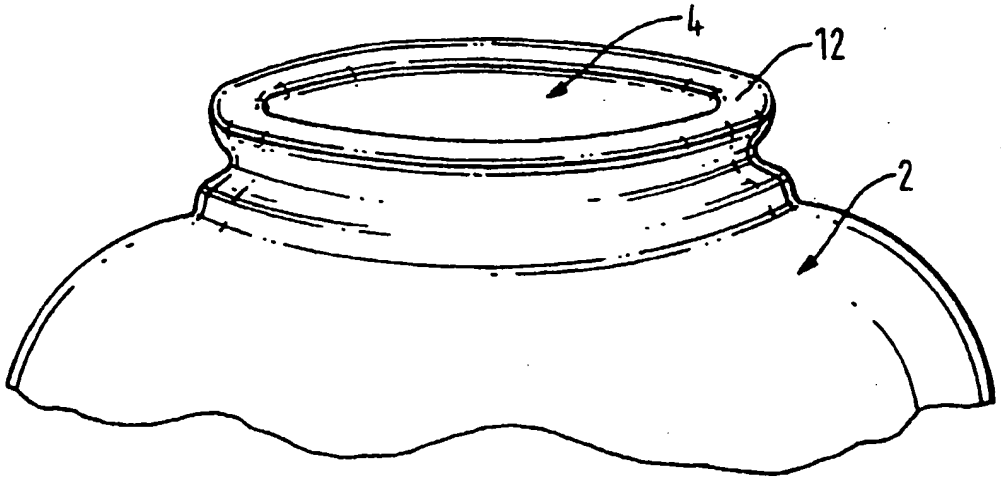

FIG.2

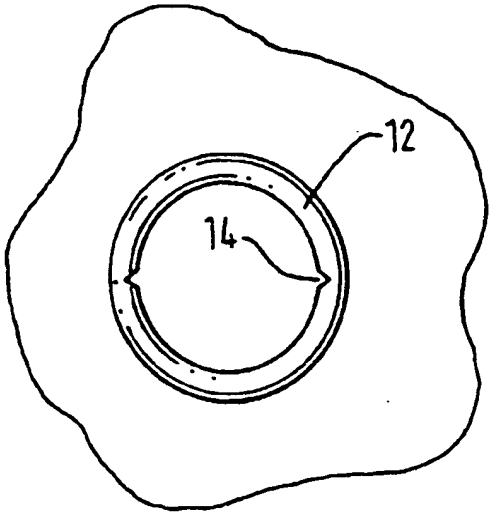

FIG.3

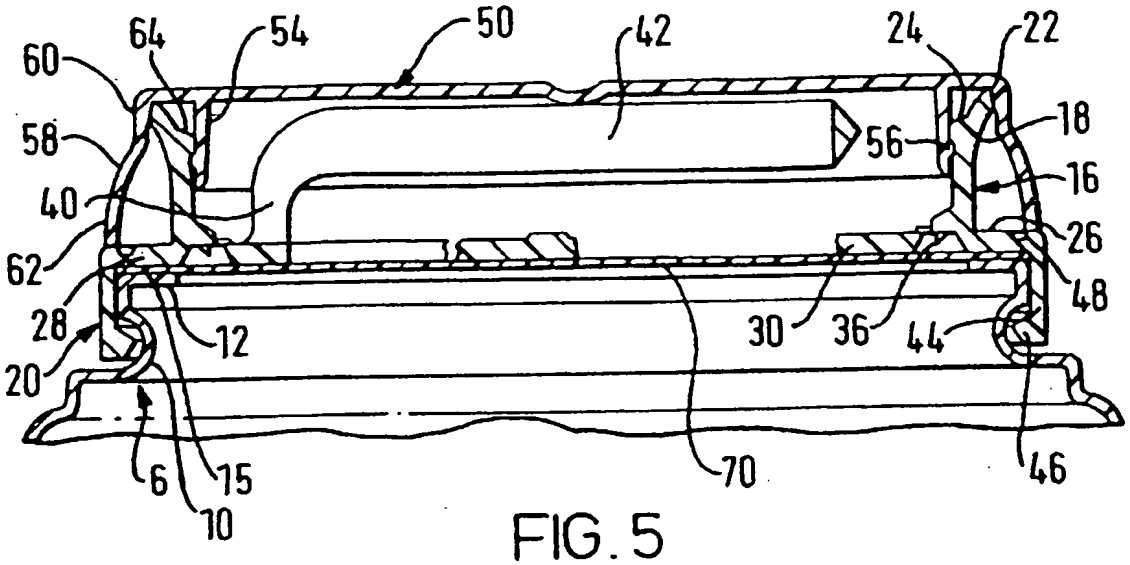
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FIG. 5

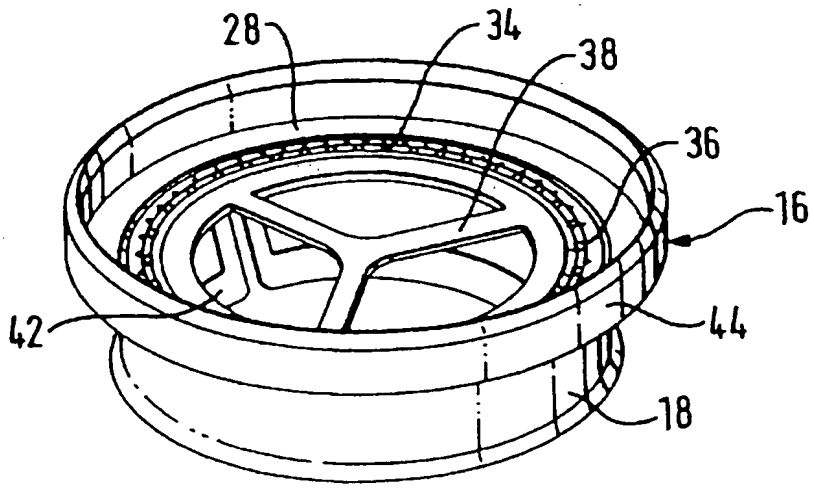
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FIG. 6

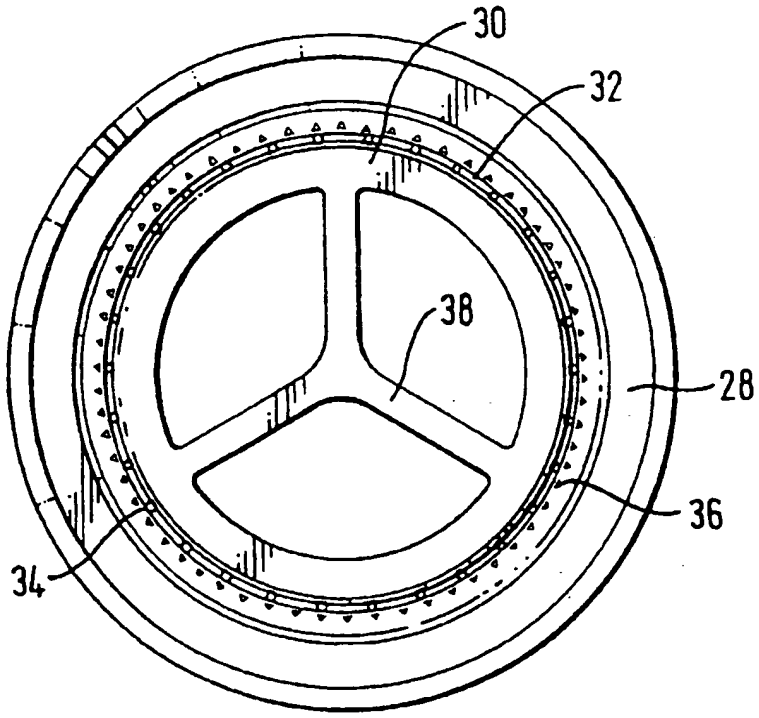


FIG. 7

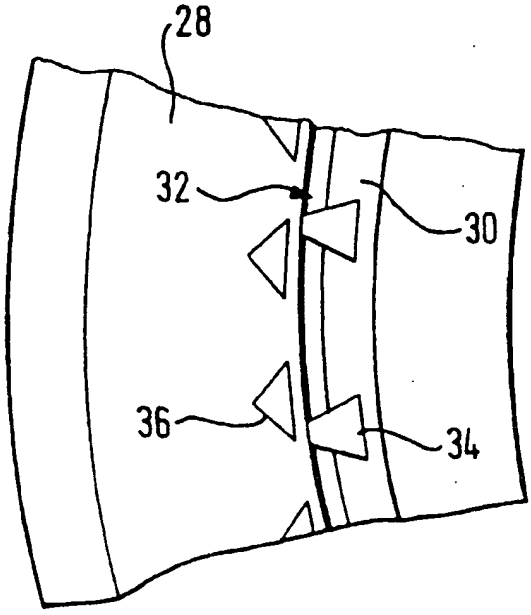
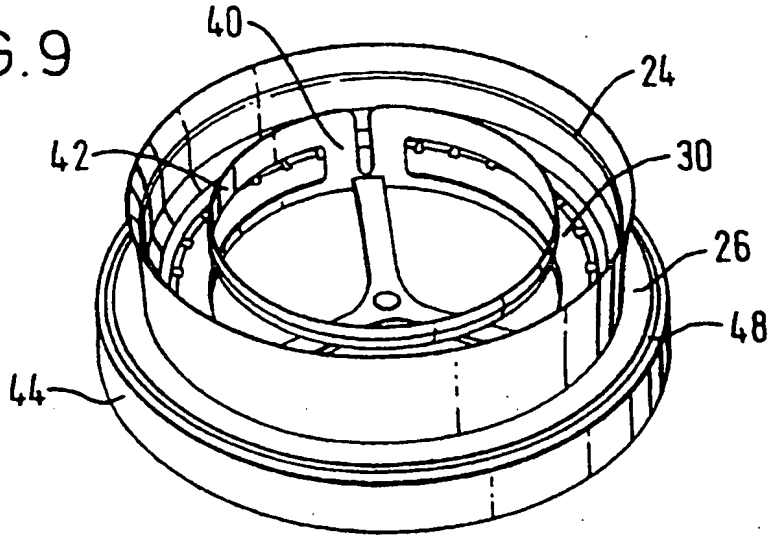


FIG. 8

FIG.9



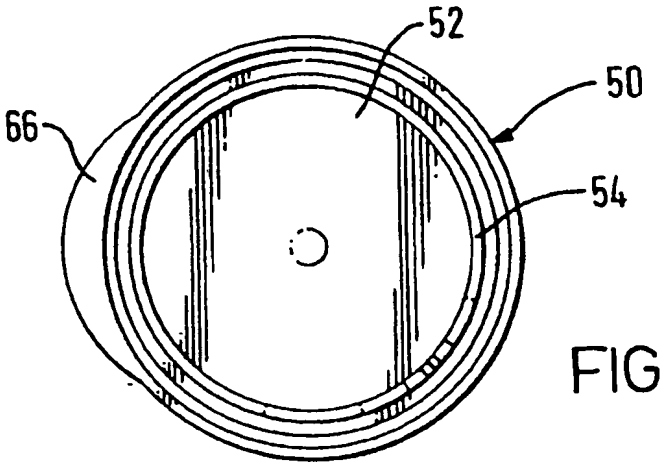


FIG.10

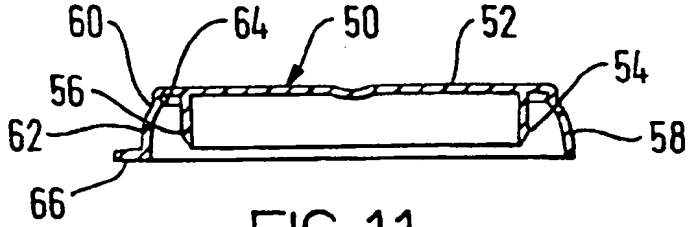


FIG.11

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Cap closure

Background of the Invention

The present invention relates to fluid packaging.

The present invention particularly relates to packaging using thin-walled extrusion blow moulded plastics bottles for fluids such as milk, which require to be filled and closed in a resealable manner.

In the specification that follows problems of packaging milk are specifically addressed. However, it will be appreciated that other pourable fluids such as fruit juice present similar packaging problems. The present invention is, however, only concerned with fluids that are not required to be packed in a pressurised manner. Containers for such fluids do not need to be gas-tight. Accordingly, the problems of packaging carbonated drinks are not addressed.

The present invention is also specifically concerned with types of packaging where the weight of the container is an issue and therefore relates specifically to thin-walled blow moulded plastics bottles.

The Technical Background

Conventionally, milk has been packaged in cardboard, gable top packs, which are notoriously difficult to open and result in numerous consumer complaints about milk spillage and difficulty in pouring. The fibre carton was only suitable for packaging liquids up to a capacity of 1.5 litres.

In order to resolve these problems blow moulded plastics polyethylene bottles have been used. These bottles are provided with resealable caps. The resealable caps are normally injection-moulded items. Since weight is significant in the packaging of fluids such as milk, these caps must also be light in weight. A weight of 2 to 4 g is usually the maximum that can be tolerated.

There is also a fundamental problem in achieving a good seal between a blow moulded bottle neck and an injection moulded plastics cap. This is because the tolerance of the neck is of the order of 0.3mm whereas the tolerance of an injection-moulded item such as the cap is 0.1mm. This means that a proportion of caps will not seal tightly when fitted to their necks. For all designs of caps this results in difficulties of fitting on the production line and, for retailers and distributors, leakage problems. The ultimate consumer may also have difficulty in resealing the bottle or opening it in the first place if the cap is over-tight.

A number of designs of injection moulded caps have been developed in an attempt to address these problems. For example, in a cap design known as a valve seal or pliable seal closure, a plug is provided in the cap which pushes into the neck of the bottle and a multiple start thread is provided on the interior wall of the cap skirt. This type of cap provides a double seal. The plug provides the seal against the inner wall of the neck. The second seal is provided by means of an inwardly projecting ridge above the threads on the inner wall of the cap, which seals against the outer wall of the neck. A pliable pull away ring around the lower edge of the cap can provide tamper evidence for this type of cap. With a cap made of low density polyethylene, it is possible to prise off the cap with the ring attached so that this form of tamper evidence is not very secure.

Another design known as the induction heat seal closure (IHS) provides a foil insert seated into the base of the cap. On the production line the filled bottles with caps fitted are passed through an induction heater, which fuses the foil to the neck of the bottle. When the consumer unscrews the cap the neck of the bottle is still sealed by the foil. This foil seal is pulled off in a separate operation. Severing the seal results in small hairs of the plastics material being raised on the surface of the bottle neck which can inhibit a good seal being formed when the cap is replaced after initial opening. The setting of parameters for the bonding process using an induction heat seal closure is critical in order to achieve a bond which is weak enough to allow the consumer to be able to peel away the foil, yet strong enough to maintain a good primary seal with the container neck. Because the presence of the foil means that no plug can be

provided the susceptibility to leakage in the consumer's home is increased as the resealing of the cap is poor. The cap is also relatively expensive as the provision of the peelable foil insert can add as much as 20% to the cost of the container.

Another set of problems arises from the production line process of filling the bottles and sealing them. Since the maximum linear speed of milk is restricted by the speed at which the milk starts to froth, the rate of filling depends upon the size of the nozzle used to pour the milk into the bottles. The nozzle size is constrained by the dimensions of the neck. For a typical milk container this is 38mm. Larger necks allow for quicker filling but present greater sealing problems and require larger caps.

In the present context the term blow moulding refers to extrusion blow moulding rather than injection stretch blow moulding. In many modern production lines, a blow moulding plant is adjacent the dairy. This allows the bottles to be formed, filled and sealed in a single continuous production process. The most complex stage in blow moulding is balancing each parison and controlling the material distribution. The parison is then inflated against the wall of a temperature regulated mould solidifying to assume the shape of the mould cavity. In one conventional design of blow moulding machine a block of moulds shuttles between an extrusion station and a blowing station. The number of die-heads provided is generally equal to the number of cavities in the block or some fraction thereof. These die-heads are fed by a head manifold that typically results in an imbalance in the delivery of plastics material to each of the resulting parisons. This process results in difficulties in forming consistently the neck-portion of thin walled containers, achieving at best tolerances of +/- 0.3 mm with repeatable accuracy. To achieve good performance with valve seal closures, it is imperative to form a perfectly round neck-bore with a minimum amount of ovality in both bore and threaded portion. Two processes are known to achieve the above result in multi-cavity blow moulding. They are namely a "pull-up" process, which is the lifting of a blow pin through a shear-steel assembly to cut a round bore in a bottle neck, or a "ram-down" process, which is the forcing downwards of a blow pin into a shear steel assembly. The drawback with pull-up is that the neck component is physically weak in its construction leading to poor sealing with valve seal closures as

the bore relaxes over time causing leakage. Ram-down however, gives a very rigid neck but this has a weight disadvantage causing ovality of the neck coupled with added cost of material wastage. Ovality causes poor sealing with valve seal closures. Neither of these two processes is suitable for moulding pour-lip features on bottle-necks. With the pull-up finish it is almost impossible to mould a pour lip feature and with the ram-down finish it requires significant amounts of extra material and is almost impossible to mould without significant ovality and imperfections in the bore.

The above processes described relate to moulding machinery manufactured by companies such as Uniloy, Techne and Bekum, for example.

An alternative type of machine made by companies such as Graham Engineering and Uniloy, which is particularly suitable for on-site blow moulding plants, uses a process which is commonly referred to as wheel blow moulding. Unlike the previous processes described, the wheel produces only one parison at a time extruded from a single die-head. The mould blocks are mounted on a rotary wheel structure and pass over the parison closing as the wheel rotates. A needle assembly pierces the parison and inflates the plastics until it solidifies against the wall of the temperature regulated moulds. Wheel blow moulding gives a high level of control in material distribution in containers produced in this way. The set up time for such a machine is significantly reduced, as only one die-head needs to be set up.

Where the inner wall of the neck provides one part of a seal, it may be necessary to provide a separate finishing station where the neck is either reamed or punch finished. The finishing step may produce swarf, which results in the risk that the swarf could enter inside the bottles and make them unsuitable for immediate filling.

For products such as milk where large quantities are required to be distributed through the retail chain, it is highly desirable to minimise the weight of the packaging. This has resulted in larger containers and thinner walls. Typical wall thicknesses for blow moulded high-density polyethylene (HDPE) are 0.4 to 0.6 mm. This results in a 4 pint (2.27 litres) bottle having a weight of around 40 g. Therefore any solution to the technical problems described must not increase the weight of the bottle and preferably

would allow weight reduction.

Prior Art

For cardboard cartons it has been proposed to provide a separate spout assembly which is secured to the carton. An example is described in WO-A 96/14249 (Capitol Spouts Inc.). This spout includes a cap and an integral inner membrane seal and is assembled to an outer wall of a filled carton. The container may have a scored portion so that when the inner membrane seal is removed it brings with it the scored portion of the container wall creating an opening through which the contents of the container can reach the spout. This assembly is not suitable for use with a plastics container where it would be impractical for the user to tear an opening in a plastics walled container. The cardboard carton will typically have a continuous inner lining. This type of spout must be fitted to the carton prior to filling and is not used for filling the container.

GB-A-2 108 464 (Container Corporation of America) describes an end closure arrangement wherein a membrane is sandwiched between and used to bond rim portions of a container body and end member to each other. The membrane has heat activatable sealing materials on both sides such as polyethylene, polypropylene or other similar types of material. The reader is told to use this type of closure with a container, which may be of all plastics, or a combination of paperboard and plastics materials. The exact method of production of the container body and end member is not further described. The specification is also silent as to the method of filling the resulting container. The specification particularly suggests use with a cylindrical cardboard container. Such containers would normally be filled from the base once the openable end had been completed and sealed.

US-A-4, 815,618 (Gach) shows a tamper indicating closure for a bottle designed for dry contents. A base section has a skirt, which engages with the neck of the bottle and defines a spout. A foil is interposed between the neck of the bottle and an adjacent surface of an upper part of the base. A pull ring is attached to a disc, which is connected to the opening in the upper part of the base by means of breakable webs.

The disc is bonded to the foil. Pulling on the pull ring, which tears the foil away from the spout, opens the closure. In an alternative embodiment of the Gach invention the disc is not joined to the base section and the foil is provided with a circumferential score line to facilitate tearing at the edge of the inner surface of the spout. In either embodiment a clean opening is unlikely to be produced. This would not be a problem when the bottle is used for tablets or the like but a torn foil edge within the spout is unsuitable for the pouring of liquids. The material of the bottle is not disclosed.

Although these documents are referred to as the most relevant prior art they do not represent a natural starting point for those seeking to solve the technical problems described in relation to thin-walled plastics bottles, in which the teaching has hitherto been directed exclusively at integral formation of the bottle body and neck.

Therefore, although it is known to produce a separate component defining a neck as in GB-A-2 108 464, the possibility of using this approach to solve the long present technical problems of effective reclosable sealing of thin-walled blow moulded plastics containers for fluids had not hitherto been appreciated and cannot therefore be regarded as obvious.

Solution of the Invention

In accordance with the present invention there is provided a thin-walled plastics bottle comprising an extrusion blow moulded non gas-tight body and an injection moulded neck and cap assembly adapted to be fused together with the body after the body has been filled with a fluid, wherein a foil is interposed between the body and the neck and cap assembly, and wherein the cap is fitted to the neck in order to provide a leak free resealable closure.

Further in accordance with the present invention there is provided a process for bottling fluid comprising the steps of: extrusion blow moulding thin-walled bottle bodies having open mouths; filling said bottle bodies; fitting an injection moulded neck and cap assembly having a base of the neck covered by a foil and sized to correspond to the open mouth of the bottle body to each filled bottle body; heat

sealing the bottle bodies to the foil of the neck and cap assemblies.

This solution has numerous advantages. The neck and cap will fit together in a reliable sealing manner as both components are formed by the same manufacturing technique, preferably injection moulding, which means both components will be subject to the same tolerances. The neck and cap assembly can be supplied from a separate factory, which can produce them in hygienic circumstances. Any of the pre-existing cap designs can be employed.

The body to which the neck and cap assembly is fitted can have a relatively wide mouth through which it can be filled, thus increasing the filling speed.

In addition, the foil is used to seal the mouth at the same time as the neck and cap assembly is fused to the mouth in a single heat sealing operation. This results in more reliable sealing of the filled bottles avoiding any leakage during the distribution and retailing cycle.

Other aspects and features of the invention are set out in the claims.

The term thin-walled as used herein is intended to refer to wall thicknesses of 2 mm or less and preferably within the range 0.1 mm to 1.0 mm. A container having a wall thickness of less than 0.1mm is unlikely to have the necessary structural integrity to hold its shape when filled with fluid. For a milk container of up to 6 pints (3.41 litres) capacity a thickness of 0.4 to 0.6 mm is appropriate.

Description of a Preferred Embodiment

In order that the invention may be well understood an embodiment thereof will now be

described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a side view of a mouth of a first embodiment of a bottle body;

Figure 2 shows a perspective view of a mouth of the bottle body of Figure 1;

Figure 3 shows a top plan view of a mouth of the bottle body of Figure 1;

Figure 4 shows a section through a side wall at a mouth of the bottle body of Figure 1;

Figure 5 shows a section through a neck and cap assembly assembled to a second embodiment of a bottle body;

Figure 6 shows a perspective view from below of a neck;

Figure 7 shows a plan view from below of the neck;

Figure 8 shows an enlarged view of a portion of the neck from below;

Figure 9 shows a perspective view from above the neck;

Figure 10 shows an underside plan view of a cap; and

Figure 11 shows a section through the cap.

A bottle body 2 has a mouth 4, which is integrally formed in a single blow moulding operation. The remainder of the body shape has not been shown as it may take any suitable form. For example it may be square, rectangular or round in section and may have an integral handle formed as part of the body shape.

The profile 6 of the mouth is best shown in Figure 4 and comprises a vertical wall 8

adjoining an indented recess 10 which merges into an inwardly directed horizontal seating flange 12. The purpose of the recess 10 is to give the mouth profile more rigidity and resistance to compression when top loaded during the subsequent operations to attach a neck and cap assembly. It is also used to locate a mouth of the neck assembly when applied in the filling process.

The body 2 with its shaped mouth profile 6 is formed by the mould against which a parison of high density polyethylene or other suitable plastics is inflated in any appropriate conventional extrusion blow moulding process. If the blow moulding takes place on a rotary machine then nicks 14 in the flange 12 as shown in Figure 3 will be formed. These are usually removed in second stage trimming by either reaming or punching after any dome of the parison guillotined from the container to leave the open mouth 6. This invention removes the necessity for this trimming and finishing. It is not necessary to remove these or any other irregularities in the internal profile of the mouth for use in the fusing of the neck to the container profile 6.

The mouth of the bottle as illustrated in Figure 5 has a modified profile from that shown in the embodiment of the bottle illustrated in Figures 1 to 4. The mouth profile of the bottle shown in Figure 5 defines a narrow shelf 15 around the mouth above the recess 10. This shelf 15 allows a neck of a neck and cap assembly to be perched on the bottle during the assembly process before the neck has been fully engaged with the bottle body. The presence of the shelf 15 allows the bodies with necks perched on them to be moved along an assembly line without the neck and cap assemblies falling off.

A neck 16 is shown in the Figures 5,6,7 and 9. The neck comprises an annular side wall 18 supported on a base 20 which fits to the bottle body and which in this embodiment comprises a flat portion covering the mouth of the bottle and a skirt which couples to the neck profile. It will be appreciated that when the closure is used with other types of container, other designs of base will be needed. For example, the base to be used with a composite container can end may use a flange which projects beyond the flat portion

covering the mouth of the opening in the can. Such a flange could be connected to the cardboard material by a fusion process or by any other known means.

The side wall 18 forms a pour spout for the container and terminates in a projecting pour lip 22, which is slightly tapered towards the pouring edge. In the illustrated embodiment the annular side wall 18 defines a slight outwardly projecting curved profile which tapers towards the pouring edge and terminates in a point where outer and inner surfaces of the wall converge. The profile of the point must be capable of being moulded in a repeatable manner. A precise point produces exceptionally good control and allows a very thin column of liquid to be poured with control from the spout. Such a precise point cannot be blow moulded without weight or cycle time penalties or both and this therefore represents a significant improvement relative to blow moulded pour lips. On the inner surface of the annular side wall 18 there is an annular bead 24 set below the pour lip. This annular bead 24 is intended to interlock with a corresponding bead 56 on a plug of a cap in a manner to be described more detail later.

Opposite the pour lip the side wall 18 merges with the flat portion 26 of the base 20. This flat portion 26 covers the mouth of the bottle body and comprises an outer annular flange 28 projecting outwardly from the side wall 18 and an inner annular flange 30. The inner flange 30 is separated from the rest of the neck assembly by an annular gap which is bridged by a plurality of spaced bridges 34 which join the inner annular flange 30 to an inner surface of the side wall 18. The gap with bridges 34 forms a frangible region 32. The bridges 34 are equally spaced relative to each other throughout the frangible region. The bridges 34 are tapered in their plan profile, which can be most easily seen in Figure 8. The bridges 34 are at their widest where they join the inner annular flange 30 and at their narrowest where they join the side wall 18. This ensures that all the bridges 34 will break adjacent the side wall 18 at their weakest portion. In an alternative embodiment, the frangible region could be provided by means of a thin skin of plastics. However, the use of the bridge structure reduces the removal force and makes it more controllable by adjustment of the number of bridges and the narrowness of the junction between each

bridge and the side wall.

As seen in Figure 5, the external edge of the inner flange 30 and the internal edge of the outer flange 26 have inclined side walls which together with the gap and base of the side wall 18 define a valley within which the frangible region 32 is located

A series of spaced pointed teeth 36 depend downwardly from the floor of the valley. Each tooth 36 as shown in Figures 7 and 8 is triangular in plan and has a saw-tooth profile section as shown in Figure 5. The teeth 36 are inclined inwardly to the centre of the base. It will be appreciated that the pitch of the teeth may be varied from that shown in the drawings. In an embodiment where the frangible region is provided by a thin plastics skin, the teeth may be located on that skin.

The inner flange 30 has three thin sprues 38 extending from its inner surface to a centre point. This construction allows the neck assembly 16 to be injection moulded from a central point which provides for a more uniform distribution of plastics material during the moulding process. If side injection is used, no sprues are necessary.

An inner face of the inner flange 30 supports two closely spaced legs or stalks 40 formed at either side of one of the sprues 38. The stalks rise and bend over and curve round until they merge to form a pull ring 42. The pull ring 42 is formed with a teardrop cross sectional profile to facilitate removal from the moulding tool. The user's finger is inserted into the ring where force can be applied opposite the legs 40. The force causes the frangible portion to sever simultaneously in both directions away from the attachment point to open the closure. This presence of two stalks reduces the risk of the pull ring 42 being broken away from the flange 30. Preferably the inner lower edge of the pull ring 42 has a curved rather than a sharp edge in order to prevent the ring cutting into the user's finger during the pulling operation.

A skirt 44 extends around the exterior of the side wall 18 and depends from the outer edge of the outer flange 28 of the base 26. The skirt 44 terminates in an inwardly

projecting rib 46 in order to engage with a recess 10 of the profile 6 of the mouth of the bottle body 2.

In the upper surface and towards the outer edge of the outer flange 28 an annular weakened recess 48 is formed. The recess 48 provides a point of weakness so that if an attempt is made after the container has been assembled to prise off the neck 16 by use of levering action between the skirt 44 and the wall of the bottle 8, the skirt will separate from the flat portion 26 indicating that the closure has been tampered with.

In an alternative embodiment (not shown) the annular side wall 18 could be provided with a shoulder so that the pour spout of the neck which is closed by a cap 50 may be of smaller diameter than the mouth of the bottle body.

The design of the side wall and pour spout of the neck 16 is dependent on the type of cap that will be used to complete the neck and cap assembly. The cap 50 in the illustrated embodiment is of the valve seal type, which provides a push fit. It will be appreciated that the neck can be adapted for use with screw on caps and for this purpose may have a thread or multi-start threads formed in an outer surface of the side wall 18 to engage with a screw thread formed in an inner wall of the co-operating cap.

The cap 50 as shown in Figures 10 and 11 is an injection moulded component comprising a cover plate 52 with a depending inner cylindrical plug 54. The cylindrical plug 54 extends vertically downward from the cover plate 52. An annular bead 56 is formed around an external surface of the plug. The bead 56 engages with the head 24 on the annular side wall 18 of the neck 16 to retain the cap 50 on the neck. Below the bead 56 the plug wall tapers inwardly to facilitate insertion into the mouth of the neck.

A depending outer skirt 58 is joined to the edge of the cover plate 52. The skirt 58 has an essentially vertical region 60 adjacent the cover plate 52 which merges into a flared region 62. The free edge of the flared region 62 opposite the cover plate 52 aligns itself with the edge of the neck skirt 44 outwardly of the weakened recess 48 so that there is an

unbroken profile of the closed neck and cap assembly. The depth of the skirt 58 is such that the edge just reaches the upper surface of the flat portion 26 of the neck 16 when the cap is fully engaged with the neck 16. The clearance of 0.5 mm is preferred in the neck and cap assemblies before they are assembled to bottle bodies.

The profile of the flared region 62 allows the skirt to flex when subject to downward pressure applied to the cap during assembly. It will also be appreciated that the alignment of the skirt 58 with an outer edge of the neck assembly ensures that downward forces applied to the cap are transmitted through the skirt 58 to the skirt 44 of the neck assembly into the body of the bottle 12. This minimises the risk of damage to the pour spout and the valley structure during assembly of the neck and cap assembly and also during resealing of the bottle.

An annular bead 64 is situated on the inside of skirt 58 of the cap close but spaced from the top of the vertical region 60. The purpose of the bead 64 is to provide a seal with the underside of the pour lip 22.

The cap 50 is snap fitted onto a mouth of the pour spout. It is sufficiently flexible not to deform the pour lip during the sealing and resealing operation. The slightly curved profile of the annular side wall 18 maintains sufficient rigidity which guides the plug of the cap when the cap is snap fitted. With the design illustrated in Figure 5 there are two sealing points between the cap and the neck. The first sealing point is between the annular bead 64 and an underside of the pour lip. The second sealing point is between the co-operative annular beads 24, 56 on the side wall 18 and the plug 54 respectively. When the cap engages with the neck, the flexing of the annular beads as they come into contact produces an audible click which indicates that a seal has formed and the cap is properly located. This two point sealing is particularly efficient at eliminating the risk of leaks. Because both the neck assembly and the cap are injection moulded components, they can be moulded accurately. This ensures that a good, repeatable engagement can be provided.

A horizontal tab 66 projects from a portion of the lower edge of the skirt 58 as seen in Figures 9 and 10. The tab 66 allows the user to lever the cap away from the neck when opening the container. The tab 66 in plan view has a curved profile providing a relatively large area of attachment to the skirt 58. Protrusion of the tab is kept to the minimum necessary for it to be lifted by fingertip. The tab must be relatively inflexible. Providing a relatively large area of attachment of the tab to the skirt reduces flexibility. Since the tab is relatively inflexible, when it is engaged by fingertip, it is easier for the user to pop the cap off the neck of the bottle by a simple pivoting or levering operation.

The use of a cap with a skirt that covers the entire upper surface of the neck assembly allows the weakened recess 48 that provides for tamper destruction of the neck assembly to be concealed when the bottles are on display. If any attempt is made to lever the skirt away from the bottle, the closure will be so damaged that store personnel will immediately be alerted to the risk that an attempt has been made to tamper with the contents of the bottle. This type of tamper evidence is believed to be more effective in terms of discouraging attempts at tampering and provides greater consumer confidence.

In order to minimise the weight of the cap; the plastics of which it is moulded may be foamed. This would allow it to be substantial enough for ease of handling yet lightweight to minimise overall weight and accordingly transport costs.

The neck is assembled to the body with an intermediate sealing foil 70. The foil 70 may be a polymer foil or a polymer foil laminated to an aluminium foil or aluminium. The foil is selected so that it is capable of being bonded on both sides and torn with minimal user force. Any of the materials traditionally used for providing a heat-seal foil in existing plastics milk bottles may be employed. A thinner foil may be necessary than has been used in prior art pealable seals in order to facilitate tearing. Any layer of polymer must also be sufficiently thin so as not to inhibit the tearability of the foil. A foil of aluminium of thickness between 12 and 25 microns with polymer layers on both sides of between 15 and 30 microns or less will tear easily in use while maintaining the necessary

seal within the cap. Where an aluminium laminate is used small perforations may be provided in the aluminium layer to allow the polymer to pass through during the heat sealing process and thereby form a bond between the flange 12 of the bottle body and the adjacent surface of the base 26 of the neck. The foil 70 is preferably supplied already bonded to the base of the neck and cap assembly. The foiled neck and cap assemblies are then delivered to a filling hall.

During the heat sealing of the foil to the lower face of the flat portion 26, there will be a certain flow of plastics material into the valley between the inner and outer flanges 30, 28. The width of the valley is critical, as this flow of material must not submerge the teeth 36. During the induction heating the spout 18 also collapses to some extent and the edge of the skirt 58 of the cap 50 will now come into contact with an upper surface of the flat portion 26.

Both the neck and cap are preferably injection moulded plastics components. Since they are both manufactured by the same method to the same tolerances the seal between neck and cap will be good. The neck and cap assemblies may by supplied to a bottling plant ready assembled, tested and sterilised.

The details of the injection moulding process and the detailed design of the tool will not be described herein as they will be readily apparent to those skilled in the art.

Filling Process

The described bottle and neck and cap assembly may be used in various ways in a filling hall of bottling plants. The bottle bodies may be supplied to the plant ready formed but this results in the need to transport large volumes and it is preferable to form the bodies in a blow moulding plant adjacent the dairy so that they can be formed and filled in one continuous production line. The absence of any requirement for further trimming and finishing the interior of the mouth of the body makes this design of bottle particularly suitable for such a process.

In a preferred embodiment of the process the bottle bodies are blow moulded using a rotary machine having a series of moulds adapted to pass beneath a single die-head for the supply of a predetermined amount of plastics material to form a parison which is subsequently inflated to form the bodies. Such rotary machines are commercially available and require only the modification of the mould to define the required mouth profile 6 instead of a more conventional neck.

The bodies are filled through the mouth with the fluid such as milk.

In aseptic packaging the foil 70 will be sprayed with a sterilising solution such as a water/paracetic acid mixture in order to sterilise the face of the foil which will be adjacent the milk in the finished container. Such a sterilising solution is marketed under the trademark OXONIA. Alternative sterilising methods such as irradiation may be employed but are at this time more expensive.

The sterilised and foiled neck and cap assemblies are supplied through a chute to a pick and place mechanism, which orients each neck and cap assembly and places it on a filled bottle body. The skirt 44 clips over the profile 6 sandwiching the foil 70 between the two components. In the next step, the neck assembly 16 is bonded to the body 12. Preferably a chute of the pick and place mechanism contains an induction coil so that as each assembly is pressed onto the body induction heating is applied to bond the foil to the body. To form an effective bond some pressure may be required to hold the body and neck firmly together during this step. The induction heating and bonding may alternatively be carried out at a separate station downstream of the pick and place mechanism. ENERCON AHLBRANDT supplies suitable induction heating machines.

Rotation generated friction heating could also be used to fuse the body and neck and cap assembly without the presence of an intervening foil.

Opening Process

When the user receives the filled bottle, the first step is to remove the cap 50 by lifting it at the tab 66 to release the seal around the pour lip and to lever the cap off. This exposes the pull ring 42. The user inserts a finger into the centre of the ring and pulls the ring upward about an axis defined in the plane of the base 20 perpendicular to the legs 40. This produces a rotational movement that stretches the foil 70 against the longer outer face of the saw tooth profiled teeth 36. The points of the teeth facilitate tearing of the foil 70 as the pull ring is lifted. The tear in the foil proceeds in a simultaneous clockwise and counter-clockwise direction until the tears meet opposite the legs 40. The lifting of the ring also causes the bridges 34 in the frangible region 32 to break. That part of the foil 70 that is fused to the flange 30 is pulled away and discarded with it.

The fluid may then be poured out of the exposed opening over the pour lip 22. When the user wishes to re-seal the bottle the cap 50 is replaced by simply pushing the plug 54 into the mouth of the neck and pressing down until the beads 24, 56 interlock. This sealing is signified by an audible snap.

Modifications of the cap closure

It will be appreciated that the same design of cap closure can be used with containers other than bottles, for example composite cartons. In such an application, the base 20 would need to be adapted to fit to the composite carton end. This may require an annular flange instead of the depending skirt 44. The flange could then be fused or otherwise connected to the carton. In all other respects the structure of a closure would remain the same.

Claims

1. A thin-walled plastics bottle comprising an extrusion blow moulded non gas-tight body and an injection moulded neck and cap assembly adapted to be fused together with the body after the body has been filled with a fluid, wherein a foil is interposed between the body and the neck and cap assembly, and wherein the cap is fitted to the neck in order to provide a leak free resealable closure.

2. A process for bottling fluid comprising the steps of:
extrusion blow moulding thin-walled bottle bodies having open mouths;
filling said bottle bodies;
fitting an injection moulded neck and cap assembly having a base of the neck covered by a foil and sized to correspond to the open mouth of the bottle body to each filled bottle body;
heat sealing the bottle bodies to the foil of the neck and cap assemblies.

3. A process as claimed in claim 2, further comprising sterilising the foil prior to the fitting step.

4. A process as claimed in claim 2, wherein the bottle bodies are blow moulded using a rotary machine having a series of moulds adapted to pass beneath a single die-head for the supply of a predetermined amount of plastics material to form a parison which is subsequently inflated to form said body.

5. A process as claimed in claim 4, wherein the bottle body leaving the mould is passed directly to a filling station.

6. A bottle substantially as herein described with reference to the accompanying drawings.

7. A process for bottling fluids substantially as herein described with reference to the accompanying drawings.

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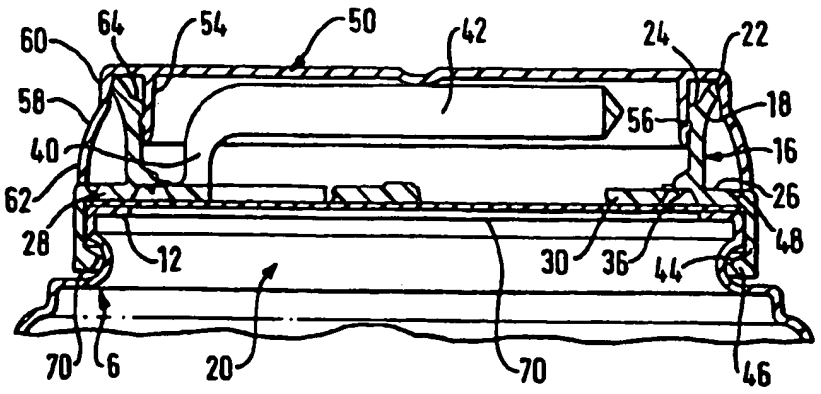

(57) Abstract

A bottle is formed from a moulded plastics body and an injection moulded neck and cap assembly which can be fused to the body after the body has been filled with a fluid. The body may be provided with a relatively wide mouth to enhance the filling speed. The bottle is particularly suitable for blow moulding in a plant adjacent to a dairy where it will be subsequently filled with a fluid and fused to a pre-sealed neck and cap assembly in a single continuous operation. A foil (70) is interposed between the body and the neck and cap assembly. The neck comprises a base (20) fitted to the body with a removable annular flange (30) connected to a pull ring (42) and secured to the foil (70). A frangible region (32) separates the removable annular flange (30) from the base (20). A plurality of depending teeth (36) each having a saw tooth profile inclined inwardly to a centre of the base are formed in the base adjacent to or in the frangible region (32) such that on removal of the pull ring (42) the foil (70) is torn by the teeth. The base may be provided with a weakened annular recess (48) that is concealed by a skirt (58) of a cap (50) when the closure is sealed. This recess (48) causes the base to break and the cap closure to be destroyed if any attempt is made to prise the base (20) from the mouth (6) of the bottle. This provides tamper evidence by destruction of the closure.

Cap closure

Background of the Invention

The present invention relates to fluid packaging.

The present invention particularly relates to packaging using thin-walled extrusion blow moulded plastics bottles for fluids such as milk, which require to be filled and closed in a resealable manner.

The invention also relates to resealable cap closures for use with plastics bottles or composite material cans, and more specifically to such closures which provide tamper evidence.

In the specification that follows problems of packaging milk are specifically addressed. However, it will be appreciated that other pourable fluids such as fruit juice present similar packaging problems. The present invention is, however, only concerned with fluids that are not required to be packed in a pressurised manner. Accordingly, the problems of packaging carbonated drinks are not addressed.

The present invention in one aspect is also specifically concerned with types of packaging where the weight of the container is an issue and therefore relates specifically to thin-walled blow moulded plastics bottles.

In another aspect, the invention is concerned with resealable cap closures that reveal when tampering has taken place

The Technical Background

Conventionally, milk has been packaged in cardboard, gable top packs, which are notoriously difficult to open and result in numerous consumer complaints about milk

spillage and difficulty in pouring. The fibre carton was only suitable for packaging liquids up to a capacity of 1.5 litres.

In order to resolve these problems blow moulded plastics polyethylene bottles have been used. These bottles are provided with resealable caps. The resealable caps are normally injection-moulded items. Since weight is significant in the packaging of fluids such as milk, these caps must also be light in weight. A weight of 2 to 4 g is usually the maximum that can be tolerated.

There is also a fundamental problem in achieving a good seal between a blow moulded bottle neck and an injection moulded plastics cap. This is because the tolerance of the neck is of the order of 0.3 mm whereas the tolerance of an injection-moulded item such as the cap is 0.1 mm. This means that a proportion of caps will not seal tightly when fitted to their necks. For all designs of caps this results in difficulties of fitting on the production line and, for retailers and distributors, leakage problems. The ultimate consumer may also have difficulty in resealing the bottle or opening it in the first place if the cap is over-tight.

A number of designs of injection moulded caps have been developed in an attempt to address these problems. For example, in a cap design known as a valve seal or pliable seal closure, a plug is provided in the cap which pushes into the neck of the bottle and a multiple start thread is provided on the interior wall of the cap skirt. This type of cap provides a double seal. The plug provides the seal against the inner wall of the neck. The second seal is provided by means of an inwardly projecting ridge above the threads on the inner wall of the cap, which seals against the outer wall of the neck. A pliable pull away ring around the lower edge of the cap can provide tamper evidence for this type of cap. With a cap made of low density polyethylene, it is possible to prise off the cap with the ring attached so that this form of tamper evidence is not very secure.

Another design known as the induction heat seal closure (IHS) provides a foil insert seated into the base of the cap. On the production line the filled bottles with caps fitted

are passed through an induction heater, which fuses the foil to the neck of the bottle. When the consumer unscrews the cap the neck of the bottle is still sealed by the foil. This foil seal is pulled off in a separate operation. Severing the seal results in small hairs of the plastics material being raised on the surface of the bottle neck which can inhibit a good seal being formed when the cap is replaced after initial opening. The setting of parameters for the bonding process using an induction heat seal closure is critical in order to achieve a bond which is weak enough to allow the consumer to be able to peel away the foil, yet strong enough to maintain a good primary seal with the container neck. Because the presence of the foil means that no plug can be provided the susceptibility to leakage in the consumer's home is increased as the resealing of the cap is poor. The cap is also relatively expensive as the provision of the peelable foil insert can add as much as 20% to the cost of the container.

Another set of problems arises from the production line process of filling the bottles and sealing them. Since the maximum linear speed of milk is restricted by the speed at which the milk starts to froth, the rate of filling depends upon the size of the nozzle used to pour the milk into the bottles. The nozzle size is constrained by the dimensions of the neck. For a typical milk container this is 38 mm. Larger necks allow for quicker filling but present greater sealing problems and require larger caps.

In the present context the term blow moulding refers to extrusion blow moulding rather than injection stretch blow moulding. In many modern production lines, a blow moulding plant is adjacent the dairy. This allows the bottles to be formed, filled and sealed in a single continuous production process. The most complex stage in blow moulding is balancing each parison and controlling the material distribution. The parison is then inflated against the wall of a temperature regulated mould solidifying to assume the shape of the mould cavity. In one conventional design of blow moulding machine a block of moulds shuttles between an extrusion station and a blowing station. The number of die-heads provided is generally equal to the number of cavities in the block or some fraction thereof. These die-heads are fed by a head manifold that typically results

in an imbalance in the delivery of plastics material to each of the resulting parisons. This process results in difficulties in forming consistently the neck-portion of thin walled containers, achieving at best tolerances of +/- 0.3 mm with repeatable accuracy. To achieve good performance with valve seal closures, it is imperative to form a perfectly round neck-bore with a minimum amount of ovality in both bore and threaded portion. Two processes are known to achieve the above result in multi-cavity blow moulding. They are namely a "pull-up" process, which is the lifting of a blow pin through a shear-steel assembly to cut a round bore in a bottle neck, or a "ram-down" process, which is the forcing downwards of a blow pin into a shear steel assembly. The drawback with pull-up is that the neck component is physically weak in its construction leading to poor sealing with valve seal closures as the bore relaxes over time causing leakage. Ram-down however, gives a very rigid neck but this has a weight disadvantage causing ovality of the neck coupled with added cost of material wastage. Ovality causes poor sealing with valve seal closures. Neither of these two processes is suitable for moulding pour-lip features on bottle-necks. With the pull-up finish it is almost impossible to mould a pour-lip feature and with the ram-down finish, it requires significant amounts of extra material and is almost impossible to mould without significant ovality and imperfections in the bore.

The above processes described relate to moulding machinery manufactured by companies such as Uniloy, Techne and Bekum, for example.

An alternative type of machine made by companies such as Graham Engineering and Uniloy, which is particularly suitable for on-site blow moulding plants, uses a process which is commonly referred to as wheel blow moulding. Unlike the previous processes described, the wheel produces only one parison at a time extruded from a single die-head. The mould blocks are mounted on a rotary wheel structure and pass over the parison closing as the wheel rotates. A needle assembly pierces the parison and inflates the plastics until it solidifies against the wall of the temperature regulated moulds. Wheel blow moulding gives a high level of control in material distribution in containers

produced in this way. The set up time for such a machine is significantly reduced, as only one die-head needs to be set up.

Where the inner wall of the neck provides one part of a seal, it may be necessary to provide a separate finishing station where the neck is either reamed or punch finished. The finishing step may produce swarf, which results in the risk that the swarf could enter inside the bottles and make them unsuitable for immediate filling.

For products such as milk where large quantities are required to be distributed through the retail chain, it is highly desirable to minimise the weight of the packaging. This has resulted in larger containers and thinner walls. Typical wall thicknesses for blow moulded high-density polyethylene (HDPE) are 0.4 to 0.6 mm. This results in a 4 pint (2.27 litres) bottle having a weight of around 40 g. Therefore any solution to the technical problems described must not increase the weight of the bottle and preferably would allow weight reduction.

Prior Art

In this specification, where a document, act or item of knowledge is referred to or discussed, this reference or discussion is not an admission that the document, act or item of knowledge or any combination thereof was at the priority date:

(i) part of common general knowledge; or

(ii) known to be relevant to an attempt to solve any problem with which this specification is concerned.

For cardboard cartons it has been proposed to provide a separate spout assembly which is secured to the carton. An example is described in WO-A 96/14249 (Capitol Spouts Inc.). This spout includes a cap and an integral inner membrane seal and is assembled to an outer wall of a filled carton. The container may have a scored portion so that when the inner membrane seal is removed it brings with it the scored portion of the container wall creating an opening through which the contents of the container can reach the spout. This assembly is not suitable for use with a plastics container

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where it would be impractical for the user to tear an opening in a plastics walled container. The cardboard carton will typically have a continuous inner lining. This type of spout must be fitted to the carton prior to filling and is not used for filling the container.

GB-A-2 108 464 (Container Corporation of America) describes an end closure arrangement wherein a membrane is sandwiched between and used to bond rim portions

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of a container body and end member to each other. The membrane has heat activatable sealing materials on both sides such as polyethylene, polypropylene or other similar types of material. The reader is told to use this type of closure with a container, which may be of all plastics, or a combination of paperboard and plastics materials. The exact method of production of the container body and end member is not further described. The specification is also silent as to the method of filling the resulting container. The specification particularly suggests use with a cylindrical cardboard container. Such containers would normally be filled from the base once the openable end had been completed and sealed.

US-A-24, 815,618 (Gach) shows a tamper indicating closure for a bottle designed for dry contents. A base section has a skirt, which engages with the neck of the bottle and defines a spout. A foil is interposed between the neck of the bottle and an adjacent surface of an upper part of the base. A pull ring is attached to a disc, which is connected to the opening in the upper part of the base by means of breakable webs. The disc is bonded to the foil. Pulling on the pull ring, which tears the foil away from the spout, opens the closure. In an alternative embodiment of the Gach invention the disc is not joined to the base section and the foil is provided with a circumferential score line to facilitate tearing at the edge of the inner surface of the spout. In either embodiment a clean opening is unlikely to be produced. This would not be a problem when the bottle is used for tablets or the like but a torn foil edge within the spout is unsuitable for the pouring of liquids. The material of the bottle is not disclosed.

Although these documents are referred to as the most relevant prior art they do not represent a natural starting point for those seeking to solve the technical problems described in relation to thin-walled plastics bottles, in which the teaching has hitherto been directed exclusively at integral formation of the bottle body and neck.

Therefore, although it is known to produce a separate component defining a neck as in GB-A-2 108 464, the possibility of using this approach to solve the long present technical

problems of effective reclosable sealing of thin-walled blow moulded plastics containers for fluids had not hitherto been appreciated and cannot therefore be regarded as obvious.

Solution of the Invention

In accordance with the present invention there is provided a thin-walled plastics bottle comprising an extrusion blow moulded non-gas tight body and an injection moulded neck and cap assembly adapted to be fused together with the body after the body has been filled with a fluid, wherein a foil is interposed between the body and the neck and cap assembly, and wherein the cap is fitted to the neck in order to provide a leak free resealable closure.

Further in accordance with the present invention there is provided a process for bottling fluid comprising the steps of: extrusion blow moulding thin-walled bottle bodies having open mouths; filling said bottle bodies; fitting an injection moulded neck and cap assembly having a base of the neck covered by a foil and sized to correspond to the open mouth of the bottle body to each filled bottle body; heat sealing the bottle bodies to the foil of the neck and cap assemblies.

This solution has numerous advantages. The neck and cap will fit together in a reliable sealing manner as both components are formed by the same manufacturing technique, preferably injection moulding, which means both components will be subject to the same tolerances. The neck and cap assembly can be supplied from a

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separate factory, which can produce them in hygienic circumstances. Any of the pre-existing cap designs can be employed.

The body to which the neck and cap assembly is fitted can have a relatively wide mouth through which it can be filled, thus increasing the filling speed.

In a preferred embodiment of the closure, the cap comprises a cover plate and a depending skirt, and the base has a weakened annular recess which is concealed by the skirt of the cap when the closure is sealed. With this construction, any attempt to prise the base from the neck of the bottle results in destruction of the cap closure as the levering force results in the base severing at the weakened recess.

Relative to the prior art defined in Gach which describes a bottle comprising a body having an open mouth, a neck and cap assembly comprising a skirt adapted to engage over the mouth and defining a pour spout and having a pull ring coupled to a removable part held within a base of the neck which seats against an upper surface of the mouth; and

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a foil interposed between the surface and the base and fused with both such that removal of the pull ring and removable part removes at least part of the foil and opens the spout; the present invention is characterised in that the removable part comprises an annular flange separated from a remainder of the base by means of a frangible valley defining a plurality of depending teeth each having a saw tooth profile inclined inwardly to a centre of the base such that on removal of the pull ring the foil is torn by the teeth.

The use of an annular flange rather than a disc as in Gach allows the neck assembly to be injection moulded in one piece by means of a mould tool which can be separated along an axis passing through a centre of the pull ring and flange. The saw tooth teeth tear the foil cleanly ensuring that it is removed with the pull ring allowing fluid to flow freely out of the spout.

In addition, the foil is used to seal the mouth at the same time as the neck and cap assembly is fused to the mouth in a single heat sealing operation. This results in more reliable sealing of the filled bottles avoiding any leakage during the distribution and retailing cycle.

The closure described is suitable for use with thin-walled plastics bodies and composite cardboard cans or other containers of any material to which a base of the closure can be fitted. Other aspects and features of the invention are set out in the claims.

The term thin-walled as used herein is intended to refer to wall thicknesses of 2 mm or less and preferably within the range 0.1 mm to 1.0 mm. A container having a wall thickness of less than 0.1 mm is unlikely to have the necessary structural integrity to hold its shape when filled with fluid. For a milk container of up to 6 pints (3.41 litres) capacity a thickness of 0.4 to 0.6 mm is appropriate.

Description of a Preferred Embodiment

In order that the invention may be well understood an embodiment thereof will now be

described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a side view of a mouth of a first embodiment of a bottle body;

Figure 2 shows a perspective view of a mouth of the bottle body of Figure 1;

Figure 3 shows a top plan view of a mouth of the bottle body of Figure 1;

Figure 4 shows a section through a side wall at a mouth of the bottle body of Figure 1;

Figure 5 shows a section through a neck and cap assembly assembled to a second embodiment of a bottle body;

Figure 6 shows a perspective view from below of a neck;

Figure 7 shows a plan view from below of the neck;

Figure 8 shows an enlarged view of a portion of the neck from below;

Figure 9 shows a perspective view from above the neck;

Figure 10 shows an underside plan view of a cap; and

Figure 11 shows a section through the cap.

A bottle body 2 has a mouth 4, which is integrally formed in a single blow moulding operation. The remainder of the body shape has not been shown as it may take any suitable form. For example it may be square, rectangular or round in section and may have an integral handle formed as part of the body shape.

The profile 6 of the mouth is best shown in Figure 4 and comprises a vertical wall 8

adjoining an indented recess 10 which merges into an inwardly directed horizontal seating flange 12. The purpose of the recess 10 is to give the mouth profile more rigidity and resistance to compression when top loaded during the subsequent operations to attach a neck and cap assembly. It is also used to locate a mouth of the neck assembly when applied in the filling process.

The body 2 with its shaped mouth profile 6 is formed by the mould against which a parison of high density polyethylene or other suitable plastics is inflated in any appropriate conventional extrusion blow moulding process. If the blow moulding takes place on a rotary machine then nicks 14 in the flange 12 as shown in Figure 3 will be formed. These are usually removed in second stage trimming by either reaming or punching after any dome of the parison guillotined from the container to leave the open mouth 6. This invention removes the necessity for this trimming and finishing. It is not necessary to remove these or any other irregularities in the internal profile of the mouth for use in the fusing of the neck to the container profile 6.

The mouth of the bottle as illustrated in Figure 5 has a modified profile from that shown in the embodiment of the bottle illustrated in Figures 1 to 4. The mouth profile of the bottle shown in Figure 5 defines a narrow shelf 15 around the mouth above the recess 10. This shelf 15 allows a neck of a neck and cap assembly to be perched on the bottle during the assembly process before the neck has been fully engaged with the bottle body. The presence of the shelf 15 allows the bodies with necks perched on them to be moved along an assembly line without the neck and cap assemblies falling off.

A neck 16 is shown in the Figures 5,6,7 and 9. The neck comprises an annular side wall 18 supported on a base 20 which fits to the bottle body and which in this embodiment comprises a flat portion covering the mouth of the bottle and a skirt which couples to the neck profile. It will be appreciated that when the closure is used with other types of container, other designs of base will be needed. For example, the base to be used with a composite container can end may use a flange which projects beyond the flat portion

covering the mouth of the opening in the can. Such a flange could be connected to the cardboard material by a fusion process or by any other known means.

The side wall 18 forms a pour spout for the container and terminates in a projecting pour lip 22, which is slightly tapered towards the pouring edge. In the illustrated embodiment the annular side wall 18 defines a slight outwardly projecting curved profile which tapers towards the pouring edge and terminates in a point where outer and inner surfaces of the wall converge. The profile of the point must be capable of being moulded in a repeatable manner. A precise point produces exceptionally good control and allows a very thin column of liquid to be poured with control from the spout. Such a precise point cannot be blow moulded without weight or cycle time penalties or both and this therefore represents a significant improvement relative to blow moulded pour lips. On the inner surface of the annular side wall 18 there is an annular bead 24 set below the pour lip. This annular bead 24 is intended to interlock with a corresponding bead 56 on a plug of a cap in a manner to be described more detail later.

Opposite the pour lip the side wall 18 merges with the flat portion 26 of the base 20. This flat portion 26 covers the mouth of the bottle body and comprises an outer annular flange 28 projecting outwardly from the side wall 18 and an inner annular flange 30. The inner flange 30 is separated from the rest of the neck assembly by an annular gap which is bridged by a plurality of spaced bridges 34 which join the inner annular flange 30 to an inner surface of the side wall 18. The gap with bridges 34 forms a frangible region 32. The bridges 34 are equally spaced relative to each other throughout the frangible region. The bridges 34 are tapered in their plan profile, which can be most easily seen in Figure 8. The bridges 34 are at their widest where they join the inner annular flange 30 and at their narrowest where they join the side wall 18. This ensures that all the bridges 34 will break adjacent the side wall 18 at their weakest portion. In an alternative embodiment, the frangible region could be provided by means of a thin skin of plastics. However, the use of the bridge structure reduces the removal force and makes it more controllable by adjustment of the number of bridges and the narrowness of the junction between each

bridge and the side wall.

As seen in Figure 5, the external edge of the inner flange 30 and the internal edge of the outer flange 26 have inclined side walls which together with the gap and base of the side wall 18 define a valley within which the frangible region 32 is located

A series of spaced pointed teeth 36 depend downwardly from the floor of the valley. Each tooth 36 as shown in Figures 7 and 8 is triangular in plan and has a saw-tooth profile section as shown in Figure 5. The teeth 36 are inclined inwardly to the centre of the base. It will be appreciated that the pitch of the teeth may be varied from that shown in the drawings. In an embodiment where the frangible region is provided by a thin plastics skin, the teeth may be located on that skin.

The inner flange 30 has three thin sprues 38 extending from its inner surface to a centre point. This construction allows the neck assembly 16 to be injection moulded from a central point which provides for a more uniform distribution of plastics material during the moulding process. If side injection is used, no sprues are necessary.

An inner face of the inner flange 30 supports two closely spaced legs or stalks 40 formed at either side of one of the sprues 38. The stalks rise and bend over and curve round until they merge to form a pull ring 42. The pull ring 42 is formed with a teardrop cross sectional profile to facilitate removal from the moulding tool. The user's finger is inserted into the ring where force can be applied opposite the legs 40. The force causes the frangible portion to sever simultaneously in both directions away from the attachment point to open the closure. This presence of two stalks reduces the risk of the pull ring 42 being broken away from the flange 30. Preferably the inner lower edge of the pull ring 42 has a curved rather than a sharp edge in order to prevent the ring cutting into the user's finger during the pulling operation.

A skirt 44 extends around the exterior of the side wall 18 and depends from the outer edge of the outer flange 28 of the base 26. The skirt 44 terminates in an inwardly

projecting rib 46 in order to engage with a recess 10 of the profile 6 of the mouth of the bottle body 2.

In the upper surface and towards the outer edge of the outer flange 28 an annular weakened recess 48 is formed. The recess 48 provides a point of weakness so that if an attempt is made after the container has been assembled to prise off the neck 16 by use of levering action between the skirt 44 and the wall of the bottle 8, the skirt will separate from the flat portion 26 indicating that the closure has been tampered with.

In an alternative embodiment (not shown) the annular side wall 18 could be provided with a shoulder so that the pour spout of the neck which is closed by a cap 50 may be of smaller diameter than the mouth of the bottle body.

The design of the side wall and pour spout of the neck 16 is dependent on the type of cap that will be used to complete the neck and cap assembly. The cap 50 in the illustrated embodiment is of the valve seal type, which provides a push fit. It will be appreciated that the neck can be adapted for use with screw on caps and for this purpose may have a thread or multi-start threads formed in an outer surface of the side wall 18 to engage with a screw thread formed in an inner wall of the co-operating cap.

The cap 50 as shown in Figures 10 and 11 is an injection moulded component comprising a cover plate 52 with a depending inner cylindrical plug 54. The cylindrical plug 54 extends vertically downward from the cover plate 52. An annular bead 56 is formed around an external surface of the plug. The bead 56 engages with the bead 24 on the annular side wall 18 of the neck 16 to retain the cap 50 on the neck. Below the bead 56 the plug wall tapers inwardly to facilitate insertion into the mouth of the neck.

A depending outer skirt 58 is joined to the edge of the cover plate 52. The skirt 58 has an essentially vertical region 60 adjacent the cover plate 52 which merges into a flared region 62. The free edge of the flared region 62 opposite the cover plate 52 aligns itself with the edge of the neck skirt 44 outwardly of the weakened recess 48 so that there is an

unbroken profile of the closed neck and cap assembly. The depth of the skirt 58 is such that the edge just reaches the upper surface of the flat portion 26 of the neck 16 when the cap is fully engaged with the neck 16. The clearance of 0.5 mm is preferred in the neck and cap assemblies before they are assembled to bottle bodies.

The profile of the flared region 62 allows the skirt to flex when subject to downward pressure applied to the cap during assembly. It will also be appreciated that the alignment of the skirt 58 with an outer edge of the neck assembly ensures that downward forces applied to the cap are transmitted through the skirt 58 to the skirt 44 of the neck assembly into the body of the bottle 12. This minimises the risk of damage to the pour spout and the valley structure during assembly of the neck and cap assembly and also during resealing of the bottle.

An annular bead 64 is situated on the inside of skirt 58 of the cap close but spaced from the top of the vertical region 60. The purpose of the bead 64 is to provide a seal with the underside of the pour lip 22.

The cap 50 is snap fitted onto a mouth of the pour spout. It is sufficiently flexible not to deform the pour lip during the sealing and resealing operation. The slightly curved profile of the annular side wall 18 maintains sufficient rigidity which guides the plug of the cap when the cap is snap fitted. With the design illustrated in Figure 5 there are two sealing points between the cap and the neck. The first sealing point is between the annular bead 64 and an underside of the pour lip. The second sealing point is between the co-operative annular beads 24, 56 on the side wall 18 and the plug 54 respectively. When the cap engages with the neck, the flexing of the annular beads as they come into contact produces an audible click which indicates that a seal has formed and the cap is properly located. This two point sealing is particularly efficient at eliminating the risk of leaks. Because both the neck assembly and the cap are injection moulded components, they can be moulded accurately. This ensures that a good, repeatable engagement can be provided.

A horizontal tab 66 projects from a portion of the lower edge of the skirt 58 as seen in Figures 9 and 10. The tab 66 allows the user to lever the cap away from the neck when opening the container. The tab 66 in plan view has a curved profile providing a relatively large area of attachment to the skirt 58. Protrusion of the tab is kept to the minimum necessary for it to be lifted by fingertip. The tab must be relatively inflexible. Providing a relatively large area of attachment of the tab to the skirt reduces flexibility. Since the tab is relatively inflexible, when it is engaged by fingertip, it is easier for the user to pop the cap off the neck of the bottle by a simple pivoting or levering operation.

The use of a cap with a skirt that covers the entire upper surface of the neck assembly allows the weakened recess 48 that provides for tamper destruction of the neck assembly to be concealed when the bottles are on display. If any attempt is made to lever the skirt away from the bottle, the closure will be so damaged that store personnel will immediately be alerted to the risk that an attempt has been made to tamper with the contents of the bottle. This type of tamper evidence is believed to be more effective in terms of discouraging attempts at tampering and provides greater consumer confidence.

In order to minimise the weight of the cap; the plastics of which it is moulded may be foamed. This would allow it to be substantial enough for ease of handling yet lightweight to minimise overall weight and accordingly transport costs.

The neck is assembled to the body with an intermediate sealing foil 70. The foil 70 may be a polymer foil or a polymer foil laminated to an aluminium foil or aluminium. The foil is selected so that it is capable of being bonded on both sides and torn with minimal user force. Any of the materials traditionally used for providing a heat-seal foil in existing plastics milk bottles may be employed. A thinner foil may be necessary than has been used in prior art pealable seals in order to facilitate tearing. Any layer of polymer must also be sufficiently thin so as not to inhibit the tearability of the foil. A foil of aluminium of thickness between 12 and 25 microns with polymer layers on both sides of between 15 and 30 microns or less will tear easily in use while maintaining the necessary

seal within the cap. Where an aluminium laminate is used small perforations may be provided in the aluminium layer to allow the polymer to pass through during the heat sealing process and thereby form a bond between the flange 12 of the bottle body and the adjacent surface of the base 26 of the neck. The foil 70 is preferably supplied already bonded to the base of the neck and cap assembly. The foiled neck and cap assemblies are then delivered to a filling hall.

During the heat sealing of the foil to the lower face of the flat portion 26, there will be a certain flow of plastics material into the valley between the inner and outer flanges 30, 28. The width of the valley is critical, as this flow of material must not submerge the teeth 36. During the induction heating the spout 18 also collapses to some extent and the edge of the skirt 58 of the cap 50 will now come into contact with an upper surface of the flat portion 26.

Both the neck and cap are preferably injection moulded plastics components. Since they are both manufactured by the same method to the same tolerances the seal between neck and cap will be good. The neck and cap assemblies may by supplied to a bottling plant ready assembled, tested and sterilised.

The details of the injection moulding process and the detailed design of the tool will not be described herein as they will be readily apparent to those skilled in the art.

Filling Process

The described bottle and neck and cap assembly may be used in various ways in a filling hall of bottling plants. The bottle bodies may be supplied to the plant ready formed but this results in the need to transport large volumes and it is preferable to form the bodies in a blow moulding plant adjacent the dairy so that they can be formed and filled in one continuous production line. The absence of any requirement for further trimming and finishing the interior of the mouth of the body makes this design of bottle particularly suitable for such a process.

In a preferred embodiment of the process the bottle bodies are blow moulded using a rotary machine having a series of moulds adapted to pass beneath a single die-head for the supply of a predetermined amount of plastics material to form a parison which is subsequently inflated to form the bodies. Such rotary machines are commercially available and require only the modification of the mould to define the required mouth profile 6 instead of a more conventional neck.

The bodies are filled through the mouth with the fluid such as milk.

In aseptic packaging the foil 70 will be sprayed with a sterilising solution such as a water/paracetic acid mixture in order to sterilise the face of the foil which will be adjacent the milk in the finished container. Such a sterilising solution is marketed under the trademark OXONIA. Alternative sterilising methods such as irradiation may be employed but are at this time more expensive.

The sterilised and foiled neck and cap assemblies are supplied through a chute to a pick and place mechanism, which orients each neck and cap assembly and places it on a filled bottle body. The skirt 44 clips over the profile 6 sandwiching the foil 70 between the two components. In the next step, the neck assembly 16 is bonded to the body 12. Preferably a chute of the pick and place mechanism contains an induction coil so that as each assembly is pressed onto the body induction heating is applied to bond the foil to the body. To form an effective bond some pressure may be required to hold the body and neck firmly together during this step. The induction heating and bonding may alternatively be carried out at a separate station downstream of the pick and place mechanism. ENERCON AHLBRANDT supplies suitable induction heating machines.

Rotation generated friction heating could also be used to fuse the body and neck and cap assembly without the presence of an intervening foil.

Opening Process

When the user receives the filled bottle, the first step is to remove the cap 50 by lifting it at the tab 66 to release the seal around the pour lip and to lever the cap off. This exposes the pull ring 42. The user inserts a finger into the centre of the ring and pulls the ring upward about an axis defined in the plane of the base 20 perpendicular to the legs 40. This produces a rotational movement that stretches the foil 70 against the longer outer face of the saw tooth profiled teeth 36. The points of the teeth facilitate tearing of the foil 70 as the pull ring is lifted. The tear in the foil proceeds in a simultaneous clockwise and counter-clockwise direction until the tears meet opposite the legs 40. The lifting of the ring also causes the bridges 34 in the frangible region 32 to break. That part of the foil 70 that is fused to the flange 30 is pulled away and discarded with it.

The fluid may then be poured out of the exposed opening over the pour lip 22. When the user wishes to re-seal the bottle the cap 50 is replaced by simply pushing the plug 54 into the mouth of the neck and pressing down until the beads 24, 56 interlock. This sealing is signified by an audible snap.

Modifications of the cap closure

It will be appreciated that the same design of cap closure can be used with containers other than bottles, for example composite cartons. In such an application, the base 20 would need to be adapted to fit the composite carton end. This may require an annular flange instead of the depending skirt 44. The flange could then be fused or otherwise connected to the carton. In all other respects the structure of a closure would remain the same.

The word 'comprising' and forms of the word 'comprising' as used in this description and in the claims does not limit the invention claimed to exclude any variants or additions.

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The claims defining the invention are as follows:

1. A thin-walled plastics bottle comprising an extrusion blow moulded non-gas tight body and an injection moulded neck and cap assembly adapted to be fused together with the body after the body has been filled with a fluid, wherein a foil is interposed between the body and the neck and cap assembly, and wherein the cap is fitted to the neck in order to provide a leak free resealable closure.

2. A closure for use with a thin-walled plastics bottle as claimed in claim 1 or another type of container having a body, wherein a foil is interposed between the body and the neck and cap assembly, and the neck and cap assembly comprises a base fitted to the body, a removable annular flange connected to a pull ring and secured to the foil, the removable annular flange being separated from the base by a frangible region, and a plurality of depending teeth each having a saw tooth profile inclined inwardly to a centre of the base formed in the base in or adjacent to the frangible region such that on removal of the pull ring the foil is torn by the teeth.

3. A closure as claimed in claim 2, wherein the cap comprises a cover plate and a depending skirt and the base has a weakened annular recess, which is concealed by a skirt of the cap, when the closure is sealed.

4. A closure as claimed in claim 2, wherein the pull ring is supported above the annular flange by means of a pair of adjacent spaced legs to promote symmetrical tearing of the foil.

5. A closure as claimed in claim 2, wherein the foil is a tearable aluminium foil coated with a fusible polymer material on both sides.

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6. A process for bottling fluid comprising the steps of:
extrusion blow moulding thin-walled bottle bodies having open mouths;
filling said bottle bodies;
fitting an injection moulded neck and cap assembly having a base of the neck covered by a foil and sized to correspond to the open mouth of the bottle body to each filled bottle body;
heat sealing the bottle bodies to the foil of the neck and cap assemblies.

7. A process as claimed in claim 7, further comprising sterilising the foil prior to the fitting step.

8. A process as claimed in claim 7, wherein the bottle bodies are blow moulded using a rotary machine having a series of moulds adapted to pass beneath a single die-head for the supply of a predetermined amount of plastics material to form a parison which is subsequently inflated to form said body.

9. A process as claimed in claim 9, wherein the bottle body leaving the mould is passed directly to a filling station.

Spreckelson McGeough Limited

09 October 2001

AUSTRALIAN PATENT OFFICE

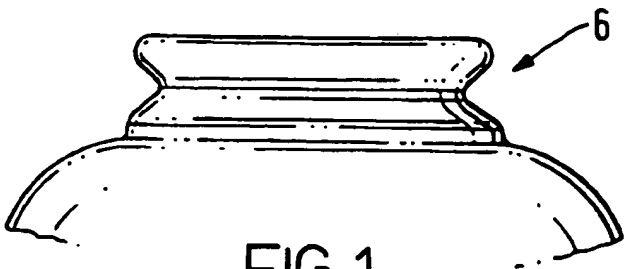

FIG.1

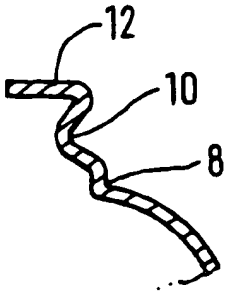

FIG.4

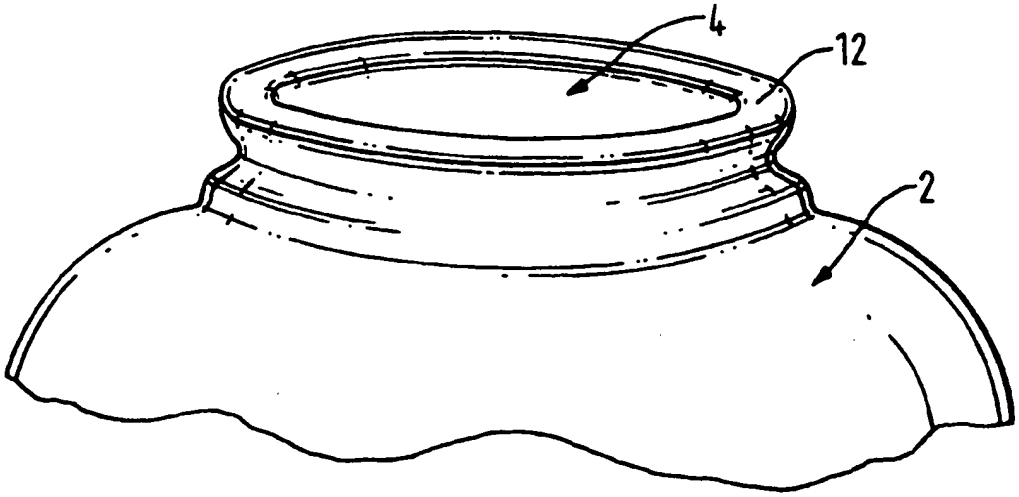

FIG.2

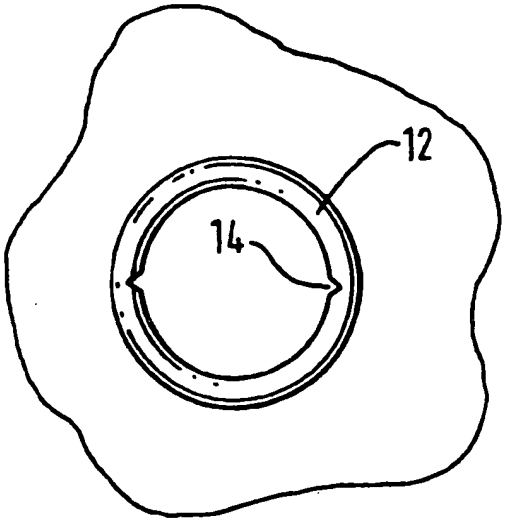

FIG.3

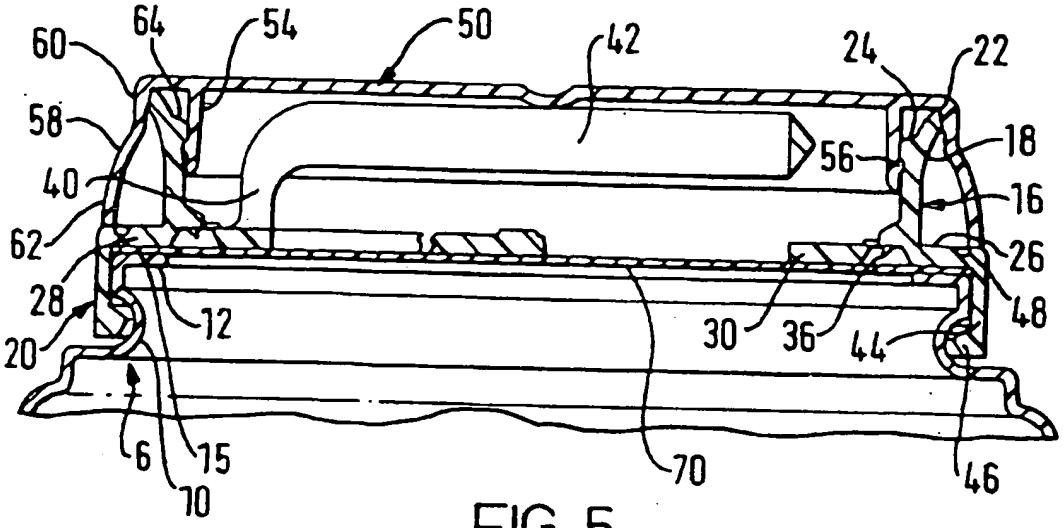
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FIG. 5

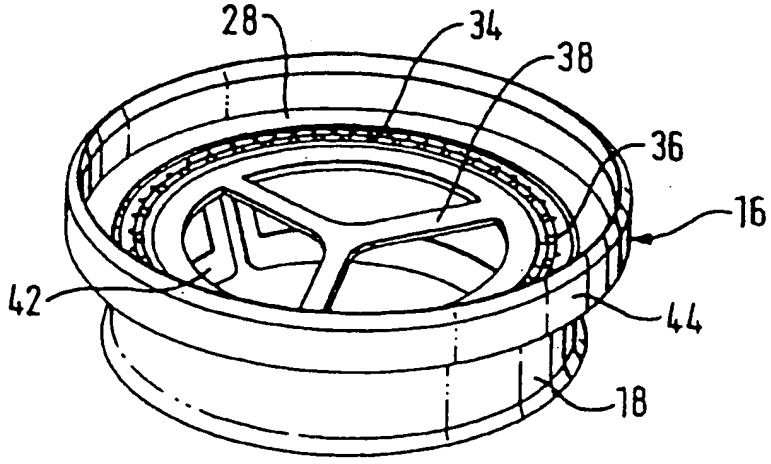
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FIG. 6

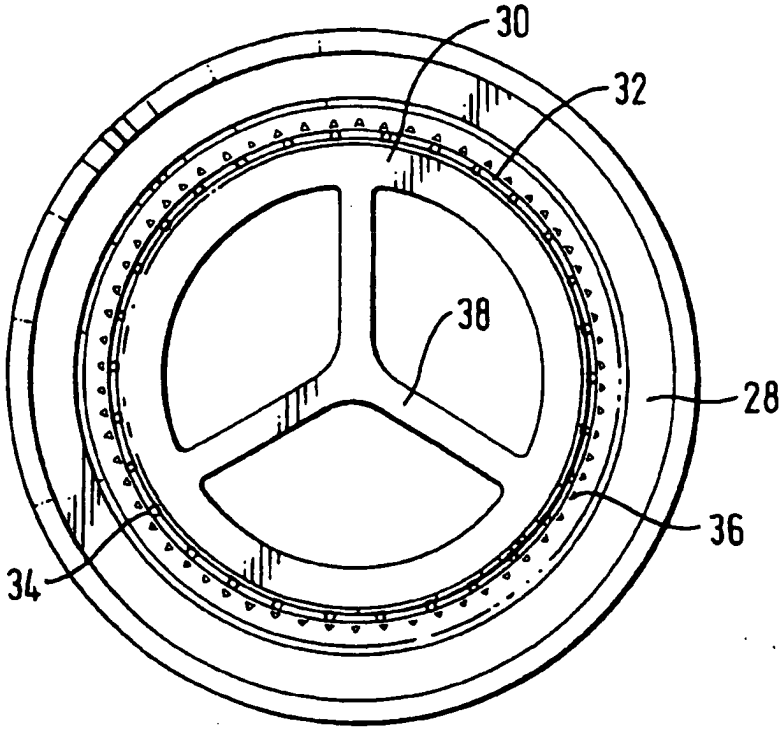


FIG.7

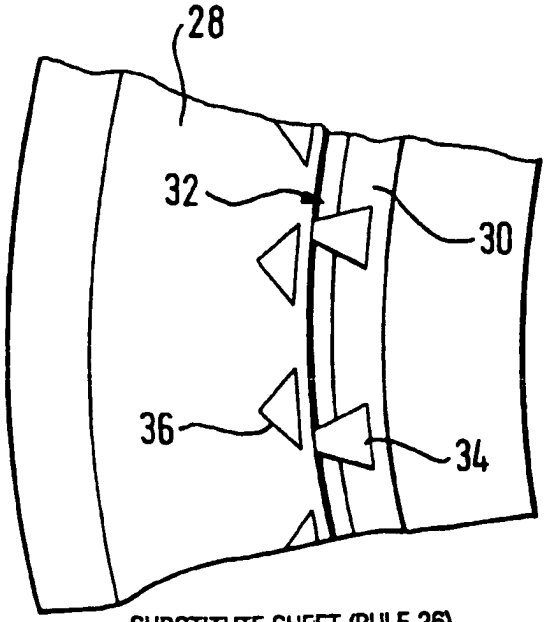
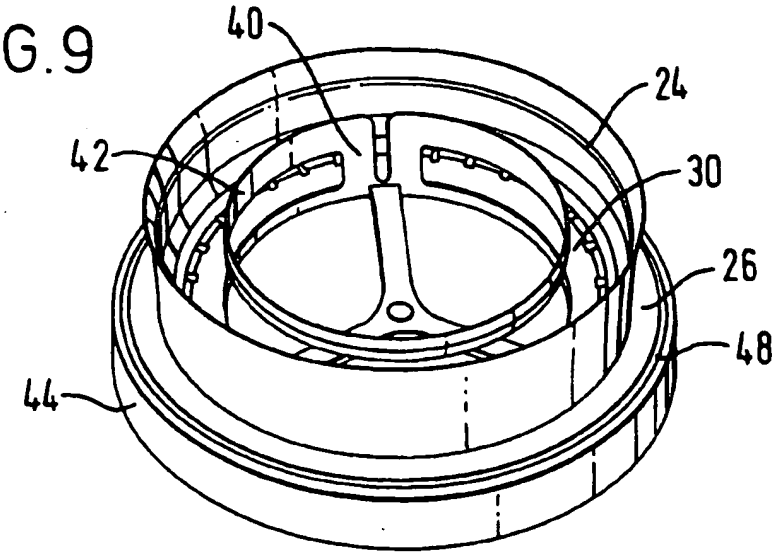


FIG.8

FIG.9



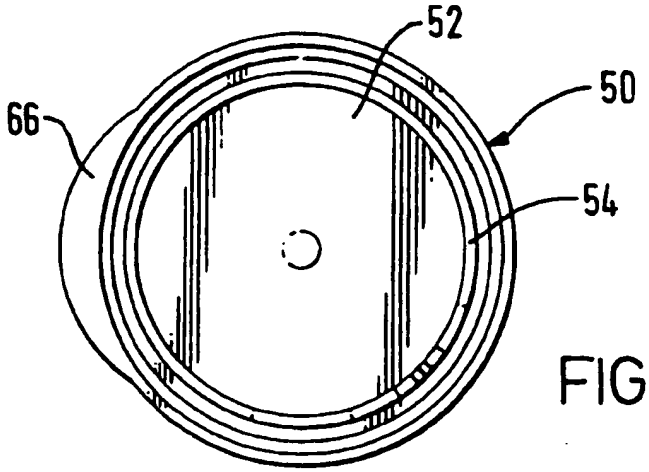


FIG.10

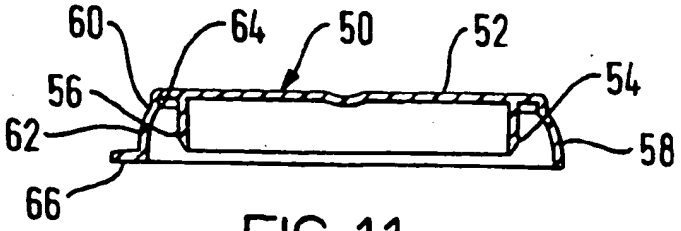


FIG.11